Motorship

Registered in U. S. Patent Office and abroad

OCT., 1927

PRICE 35c.

Motorship

Reg. U. S. Pat. Office and abroad. Copyright 1927 by Motorship.

Published on the 25th of the month prior to each title month of issue. Subscriptions: U. S. and Mexico, $4; other countries of the Postal Union, $5. Single copies, 35 cents. Bound volumes of previous years, $10. Main Office: 220 West 42nd Street, New York, N. Y.

Changes in advertising copy must be received by the publisher 3 weeks prior to the date of publication when proofs are desired, and orders for discontinuance of advertising must be received not later than the 1st of the month prior to the title month of issue.

Volume XII October, 1927 *Number 10*

Three Hundred Million Dollars Proposed for New Ship Construction

Congress Warming to Proposals for Replacing Obsolete Vessels in Our Merchant Fleet with Craft Capable of Meeting Today's Ocean Competition.

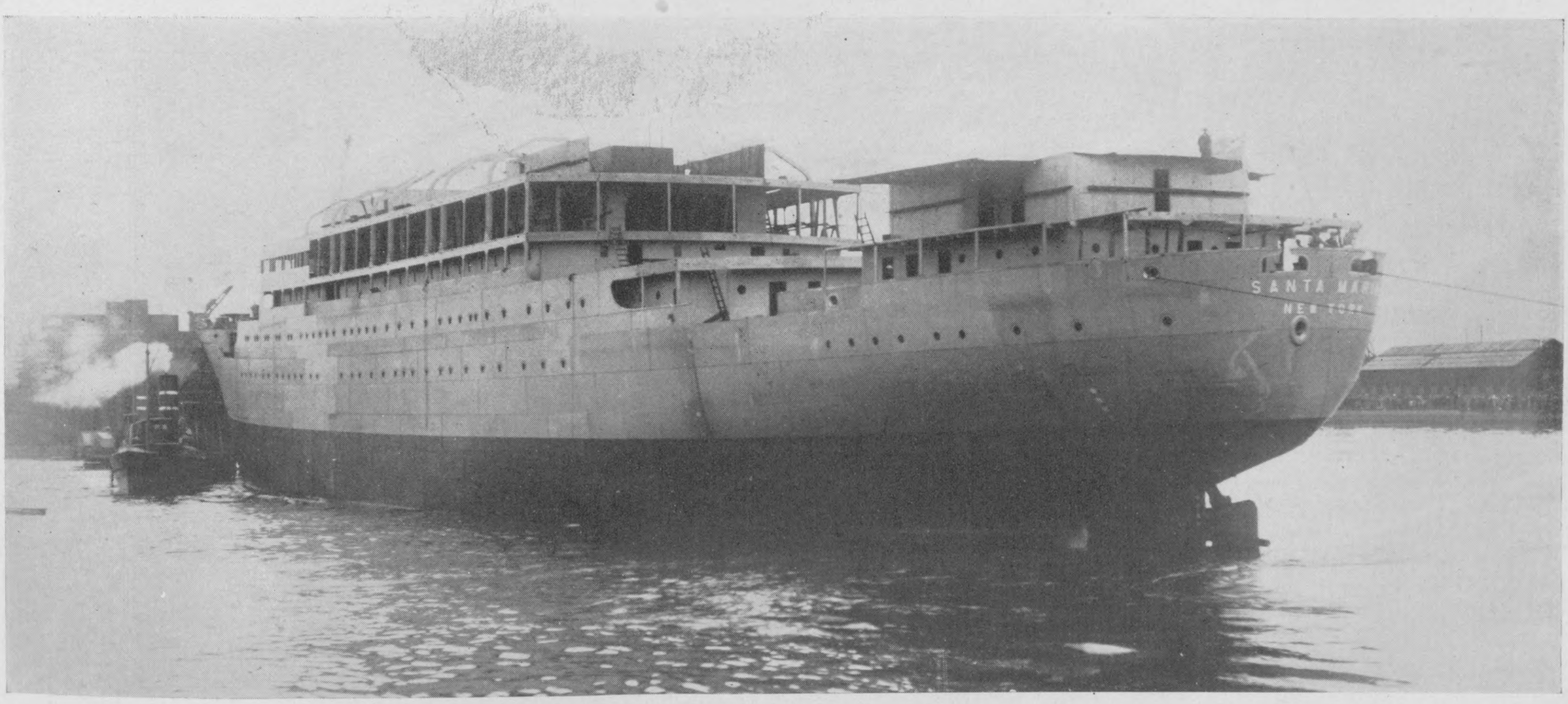
THE fact that the coming session of Congress will devote considerable attention to shipping, is welcome news to the entire marine industry. Not since the war have leaders of Congress been so favorably disposed towards building-up our mercantile marine as they are today. Plans for an appropriation of $300,000,000 for replacement of obsolete vessels constructed under wartime conditions are under consideration at the present moment.

Senator Wesley L. Jones, Chairman of the Committee on Commerce, who has an excellent understanding of the shipping needs of the country, and who has in the past devoted a great deal of time to the problem, and Representative Martin B. Madden, Chairman of the House Committee on Appropriations, seem determined to carry through the appropriation, as well as do Senator Duncan U. Fletcher, former Chairman of the Commerce Committee, and Representative W. R. Wood, Chairman of the Sub. Committee in charge of merchant marine appropriations.

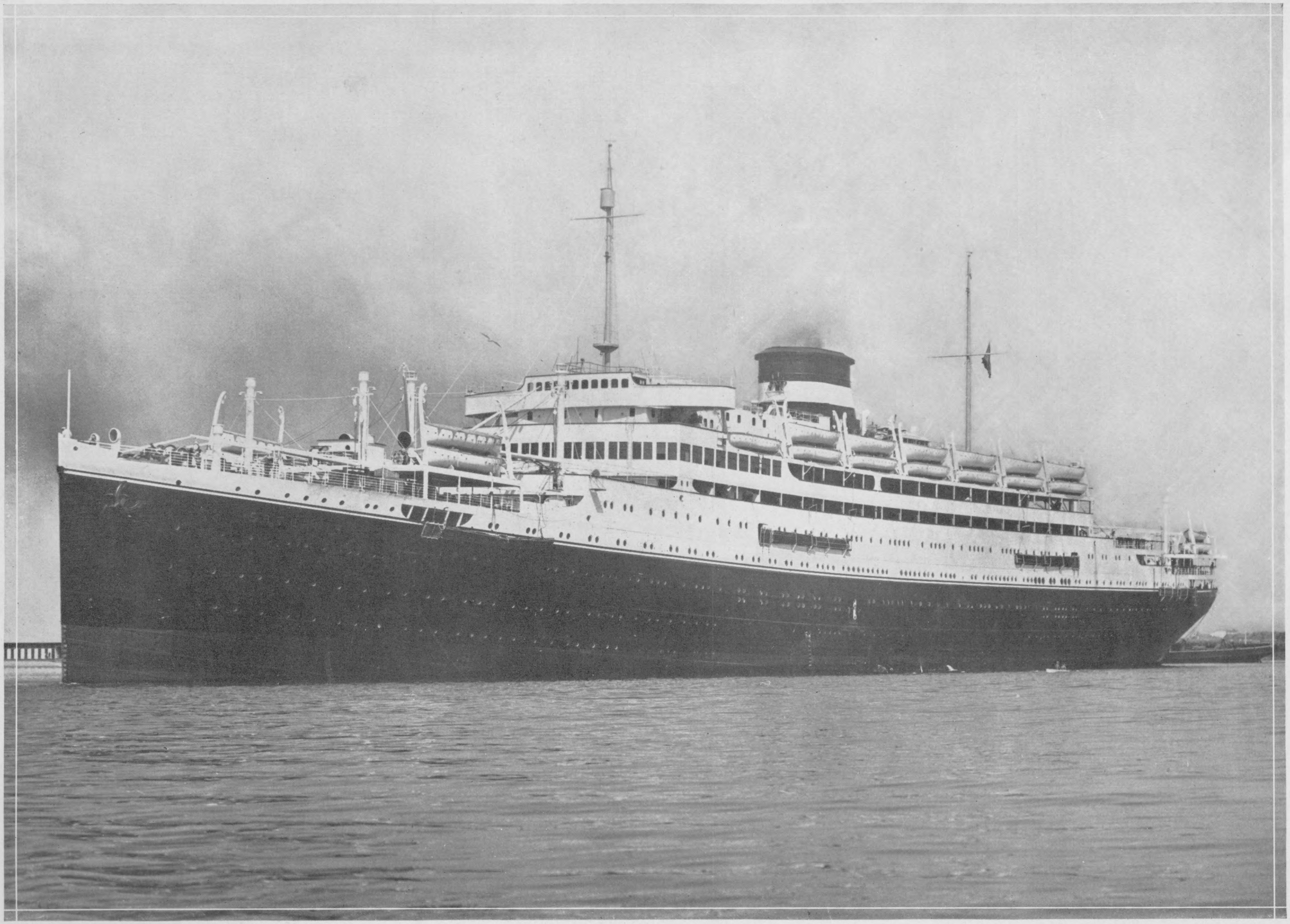
President Coolidge, realizing the necessity of efficient equipment in business and transport, has expressed himself as much concerned over the present and future of the Mercantile Marine and over the indifference of shippers and railroads to route freight by American bottoms. He has the proposals for expenditure in new construction before him.

The really serious point is not the indifference of shippers and railroads to using American bottoms, but supplying American bottoms which shippers can use on a parity with foreign-owned vessels.

There is no need for MOTORSHIP to point out that practically every other industry in the country is assisted by a tariff barrier against foreign competition for the purpose of maintaining the higher living conditions of American labor. Our whole economic structure is based on it. Yet there are those who believe that our overseas shipping industry needs no protection or assistance. Furthermore, Congress has in the past decreed that the living scale on American ships shall be the equal of labor conditions ashore, yet has insisted that there shall be no subsidy given on any new and modern ships which we badly need.



Grace Line of New York's combination passenger-cargo motorship Santa Maria just after her recent launch at the Furness shipyard in England. She is propelled by high-powered Sulzer-Diesel engines. The U. S. Government should build modern, efficient and economical vessels like this in American yards, or assist private owners to do so



Why Does The World's Greatest Nation Linger Behind Smaller Countries Where Ships Like This Are Concerned?

Saturnia—a new big motorliner—one of two just built for the Italian Cosulich Line. Gross tonnage 23,940 tons. Power in twin screws 20,000 s.hp. Speed 19 knots. Length 631 ft. 3 in. Breadth 79 ft. 9 in. Total complement—passengers and crew—2638 persons. Complete plans and specifications for two larger and more powerful Diesel-driven American passenger ships were completed by the Shipping Board over a year ago, but no action has yet been taken. It is fine modern ships of this type that America urgently needs to augment her passenger-carrying merchant marine. If private enterprise cannot build them the Government should step in! Let us delay no longer!

This $300,000,000 is the first real ray of light the shipping industry has had in a long time, and the fact leaders in Congress are considering its use not merely for conversions—but for new ships, will be great stimulus to the entire industry. All things being equal, every manufacturer and railroad is willing to ship in American bottoms —the problem is to make "all things equal" and that can only be done by Government cooperation.

Obviously in order to make it possible for owners to offer space to American shippers and railroads in competition with foreign space, the cost of operation must be reduced to the lowest possible minimum, and our ships must be equal to or a little better than those of other nations. The motorship has fully demonstrated not only here, but abroad, that it is the most economical ship to operate regardless of its somewhat higher first cost. It enables better speed to be obtained without interfering with cargo space, has greater cargo and passenger capacity, enables cargo to be carried more cheaply, increases cruising range without purchasing bunkers abroad, offers better working conditions for crew, and is a more efficient ship all around.

Any attempt to install steam engines in modern ocean-going freighters and passenger liners under 30,000 hp. means we are simply forcing the shipowner to ask a higher price for his space and defeating the entire purpose of the proposed appropriation. Representative Wood, who has recently returned from Europe after a study of foreign shipping, has pointed out that all the German, French and Italian ships now constructed are being Dieselized and that we have to meet the problem of these economical ships.

The expenditure of $300,000,000 for new construction will do much towards maintaining our great shipyards, which are badly needed for both war and peace purposes. It will prevent skilled naval architects, ship and engine draftsmen and shipyard hands engaged on big ship work from passing on to new professions, and will ensure of new apprentices being trained for the future. It will provide sufficient work in the way of ocean-going hulls for the American Diesel engine builders to power. The latter have developed high powered, efficient and economical machinery at great cost; and long intervals between orders make the production of these great marine power plants exceedingly costly. The new construction plans will prevent this gap and reduce production costs.

It is far better for the State to build ships than for but few ships to be laid down, because there is always the prospect of private interests later acquiring the vessels under terms which would enable profitable operation to be carried on. President Coolidge has made it clear that he desires the Government to get out of the ship-operating business as quickly as possible. On the other hand, leaders of Congress seem determined that the Government shall continue to operate ships until private shipowners take them over. As it is only possible for shipowners to slowly absorb Government ships, and very slowly until some of our existing laws are changed, all those interested in ships and ships' machinery should urge their Congressmen to support the proposed shipping legislation when it is brought before the House and Senate. Just now the tendency in Congress is one of very warm interest towards doing something substantial for our Merchant Marine. This tendency can be changed to a real desire, and our legislators made shipminded.

It is to be hoped that Congress' plans will make it possible for shipowners to acquire any vessels built at advantageous terms, such as loaning 75 per cent of the constructional costs at the lowest rate of interest at which the Government can borrow money, and to spread terms of payment over ten or fifteen years, and to carry its share of the insurance as well as adopt a higher rate of depreciation. The reason for this is apparent when it is pointed out that since the slow revival of shipping following the great slump of 1921, over 100 motorships, steamers and other craft valued at over $125,000,000 have been constructed in foreign yards with American money and operated 100 per cent from the United States but under foreign flags. If the right types of ships are planned and not too many strings attached to sales more private ships will be American built.

Encourage Motorship Construction by Reducing Loan Interest Rate

WHEN the Merchant Marine Act of 1920 became law it contained a clause that formed a most valuable assistance to American shipping. We refer to Section Eleven which permitted the Shipping Board to loan $125,000,000 to citizen shipowners at the very low rate of 2 per cent per annum. As an example of its benefits we mention that the yearly capital charge on an American motorship costing one million dollars of which two-thirds was loaned at 2% would be no more than that on a foreign vessel costing half that sum to build.

Unfortunately, no sooner had Congress passed the Jones Bill, as it was called, than a world shipping slump commenced and shipowners could not afford to build ocean-going ships even if the total value of the tonnage had been loaned at this low interest rate. Consequently, until a few years ago when shipping improved few owners availed themselves of the Loan Fund, except for some coastwise craft.

The Loan Fund has lately been used for new steamship construction, but the inference to be gained from reading the Act is that Congress had motorship construction in mind but left a loophole in case steamers were more economical for some services. When Congress later amended Section Twelve of the Act it made itself clear that at least the money covered in the amendment could only be used for motorships, but it did not so alter Section Eleven. Fearing that the word "Diesel" was a trade name legislators considered it inadvisable to use it in the Act, especially as it would have prevented use of the fund for any possible more economical form of power when developed commercially. So the phrase—"such vessels shall be equipped with the most modern, the most efficient and the most economical type of machinery and commercial appliances," incorporated as a basic part of Section Eleven, remained unaltered. Exactly what it means in terms of machinery has never been legally argued.

In 1923 Congress amended Sections Eleven and Twelve of the Loan Fund so as to permit the transfer of $25,000,000 to the Shipping Board for the conversion program now under way, and to allow private shipowners to borrow money for conversion of steamers to Diesel power. The words "internal combustion engines" were then definitely included. The interest rate was then increased from 2½ per cent to 4¼ per cent on the grounds that this was the rate of interest the Government was paying for borrowed money, and that farmers were paying this rate to the Government. This interest it now transpires, is too high for shipowners to pay, and little use is likely to be made of the fund by private shipping interests unless the rate is materially reduced even though shipping conditions are improving. It should be reduced by means of another amendment, and the interest rate be put on a flexible basis in accordance with current money rates so that shipowners can borrow money at least as cheaply as the Government itself.

Today different financial conditions exist, and the Government is obtaining cash at 3 and 3¼ per cent. This reduction would prove a great stimulus to our foreign-going shipping.

Before closing the last session Congress passed a bill permitting the Shipping Board to bring the Loan Fund up to its full strength of $125,000,000. Apparently it is the intention of the Administration to maintain permanently the fund at this figure. But with too high an interest rate the cash will remain idle and the Fund may be worse than useless to a privately-owned American merchant marine, except for coastal ships.

When the Act is again amended the opportunity should be taken to further assist private shipowning and ship operation by increasing the amount of the loan to 75% of the value of the ship, and for the Government to take care of its equity by covering the insurance on its part of the ship still unpaid, and so relieve the shipowner of quite a burden. Elimination or alteration of Par. G. Sec. 11, would accomplish this. It is reasonable and logical and should be done. Another elimination desirable is the present addition of $10 per ton over the conversion costs, which the shipowner now has to pay.

Shipping Board Orders Eight More Big Diesel Engines.

CONTRACTS have been awarded to four manufacturers for Diesel engines under the Shipping Board's second conversion program. It will be recalled that six companies bid, quotations being given in detail on page 681 of the Sept. issue of MOTORSHIP. Busch-Sulzer Bros. Diesel Engine Co., Hooven, Owens, Rentschler Co., McIntosh & Seymour Corp. and the Worthington Pump & Machinery Corp. have each received orders for two Diesel engines, all deliveries to be within 185 days.

As will be seen by the following table six engines are of the double-acting type and two engines of the single-acting type. In the case of the double-acting engines four will be of 2-cycle and two of 4-cycle. The single-acting engines are also the 2-cycle type so it will be seen that 2-cycle engines are easily in the majority. The average price per shaft hp. is $74.00. The second conversion program also consists of the conversion of two freighters to Diesel-electric drive, and bids have been called on the Diesel engines and electrical machinery for opening on October 3rd.

U. S. Shipping Board's Second Conversion Program Diesel Engines Ordered

Name of Engine Builder	No. of Engines Ordered	Shaft Horsepower Per Engine	R.P.M.	Type	Price per S.Hp.	Price for Two Engines
Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo.	2	3,950	104	6-cyl., 2-cyc. S. A.	$74.00	$584,600
Hooven, Owens, Rentschler Co., Hamilton, O.	2	4,000	115	4-cyl., 2-cyc. D. A.	74.00	592,000
McIntosh & Seymour Corp., Auburn, N. Y.	2	3,900	110	5-cyl., 4-cyc. D. A.	74.00	577,200
Worthington Pump & Machinery Corp., Buffalo, N. Y.	2	3,625	115	4-cyl., 2-cyc. D. A.	74.00	536,500
				Total		$2,290,300

List of Converted U. S. Shipping Board Motorships

	Ship	Dwt. Capac.	Main Engine	Maker	Hp.	R.P.M.	Where Converted
1	Tampa	9,120	4 cyl., d. a., 2 cyc.	Worthington	2,900	95	Newport News S.B. Co.
2	Unicoi	8,230	4 cyl., d. a., 2 cyc.	Worthington	2,900	95	Newport News S.B. Co
3	West Honaker	8,006	6 cyl., s. a., 4 cyc.	McIntosh & Seymour	2,700	95	Bethlehem S.B. Co.
4	West Cusseta	8,006	6 cyl., s. a., 4 cyc.	McIntosh & Seymour	2,700	95	Bethlehem S.B. Co.
5	Crown City	8,006	6 cyl., s. a., 4 cyc.	McIntosh & Seymour	2,700	95	Bethlehem S.B. Co.
6	Sawokla	9,125	6 cyl., s. a., 2 cyc.	Busch-Sulzer	3,000	90	Newport News S.B. Co.
7	City of Rayville	9,125	6 cyl., s. a., 2 cyc.	Busch-Sulzer	3,000	90	Newport News S.B. Co.
8	City of Dalhart	9,125	6 cyl., s. a., 2 cyc.	Busch-Sulzer	3,000	90	Newport News S.B. Co.
9	Yomachichi	9,125	6 cyl., s. a., 2 cyc.	Busch-Sulzer	3,000	90	Newport News S.B. Co.
	Ships Completing Conversion with Modified Passenger Accommodations						
10	Seminole	9,569	4 cyl., d. a., 2 cyc.	Hooven Owens—M.A.N.	3,688	115	Todd S.S. & D. D. Co.
11	Wilscox	9,497	4 cyl., d. a., 2 cyc.	New London—M.A.N.	3,688	115	Bethlehem S.B. Co.
12	West Gramma	*	4 cyl., d. a., 4 cyc.	McIntosh & Seymour	2,700	95	Bethlehem S.B. Co.

*Not yet completed.

Atlantic Refining Tanker Completes Maiden Voyage

FOLLOWING a successful trial trip the first of the three additional tankers being converted to Diesel power by the Atlantic Refining Company—POINT BREEZE—went down the Delaware River en route to Antwerp, Belgium, without returning to the owners' plant. She arrived in Antwerp September 15th. This vessel was formerly the 7,000 tons steam tanker J. M. CONNALLY purchased with two others from the U. S. Shipping Board and converted, to Ingersoll Rand-General Electric Diesel-electric drive at the owners' own plant under the supervision of Lester M. Goldsmith, Consulting Engineer for the Company. The two other boats SHARON and BESSEMER are being converted at Mobile, Ala., at the Alabama Drydock & Shipyard.

The POINT BREEZE is equipped with three Ingersoll-Rand four-cycle Diesel engines turning at 225 r.p.m. Each is connected to a 525 kw. at 250 volt General Electric generator for propulsion and a 50 kw. auxiliary generator for excitation and the ship's auxiliary power. On the propeller shaft is a 1,800 hp. at 90 r.p.m., 750 volt General Electric double motor. All the auxiliaries are electrically driven. Full particulars concerning this boat's interesting conversion will be published in an early issue of MOTORSHIP.

A Complete Diesel Service

The service from Mediterranean ports to the Pacific Coast of North America inaugurated in October, 1925, by the Navigazione Libera Triestina of Trieste was started with a fleet of steamers. Since then there has been a steady replacement of the steamer with modern motorships, the first being the MS. LEME of 11,000 d.w. tons capacity with 2,500 s. hp. in twin Tosi engines, which came out in the spring of 1926. Then came the MS. FELLA of 9,900 tons d.w. a single screw vessel which Burmeister & Wain type engines of 2,400 s.hp. Following her was the CELLINA of the same size and power, and in April, 1927, Vancouver, B. C., the most northerly port of call for this line on the Pacific Coast was visited by the MS. FELTRE, a similar ship to the FELLA and CELLINA. She measures 430 ft. b.p., 55 ft. 3 in. beam, and 38 ft. 2½ in. moulded depth. Her deadweight capacity is 9,900 tons, and like the others she was built in Italy, being constructed by the Stablimento Technico of Trieste, while her engine is a B. & W. 6 cylinder unit of 3,500 i. hp. with 29⅛ in. bore and 59 in. stroke. She is reported as making 15½ knots on her trials, and 12½ to 13½ knots at sea. MS. FELTRE has comfortable accommodation for 38 passengers. She is well equipped throughout with electric deck machinery, and has a Marconi radio compass; which is an indication of the intention to have these ships quite up to date in every respect. MS. RIALTO just completed by the builders,, with the ships already in operation, gives complete motorship service on this run.

Motor Liners for French Line

Two 20,000 tons gross cabin-class passenger motorliners are to be built for the French Line's New York service, as well as three cargo motorliners for the Company's Pacific trade.

First of a Fleet of Nine Motorships

There was recently launched from the Harland & Wolff Shipyard, Belfast, the cargo ship KING EDGAR, the first of nine motorships for the King Line Ltd. The KING EDGAR, as the vessel is named, is a 400 ft. vessel equipped with one 6-cylinder, 4-cycle, single-acting Harland-B. & W. Diesel engine.

Conversion of Big Fleet Fundamentally Sound

Prompt Diesel Powering of 100 Shipping Board Vessels Will Hasten Their Transfer to Private Ownership

By Marinus

As the world knows, after an expenditure of over three billion dollars in a feverish endeavor to meet overnight our war-time shipping needs, we found ourselves in possession of a huge fleet and the intriguing problems of its disposal. Pursuant to the mandate of the Jones Act, the U. S. Shipping Board has since sold its best passenger services, as well as a large number of freighters for the domestic trades, but thus far only three foreign cargo services have been absorbed, namely: the American South Africa, the Export and recently—the American Scantic Lines.

As matters now stand, excluding ten passenger vessels yet operated on the North Atlantic, there remain 25 cargo services at present served by 235 freighters totalling about 2,000,000 D.W.T. under the management of 22 Operators. There are also held in reserve 29 spot vessels aggregating about 260,000 D.W.T.

Of the ships in operation only the "William Penn" and nine of the twelve vessels comprising the Board's initial conversion program are propelled by Diesel engines. Therein largely lies the explanation for the dwindling volume of export cargoes and the failure to dispose of a substantial portion of these steamer services, even though they are offered at nominal prices in consideration of guaranteed operation for a period of five to ten years.

To be sure, these services have been greatly stabilized and huge savings effected by co-ordination and improved operation, yet their maintenance still costs approximately $12,000,000 a year, that is to say—an average yearly operating loss of nearly $50,000 per vessel.

No doubt some of the steamships have potential possibilities and may be eventually sold, but many are pioneer ventures operating in new lines requiring years of tireless efforts to develop into profitable operation, while others serve highly competitive routes much over-tonnaged by the faster and more efficient vessels of our foreign competitors. It must be remembered that the Board's steamers are from seven to ten years old, not especially economical in fuel or upkeep, and while we have been dormant, our competitors have been methodically replacing and enlarging their Fleets with fast, modern and economical motorships. This inferiority, added to the many other handicaps of American vessels in foreign trades, naturally makes our operators reluctant to absorb the Government's steamers. Contrasted to the Board's ten motorvessels, 28 prominent foreign shipowners have Fleets totalling 280 Diesel ships; 18 are operating Diesel ships exclusively while 12 Fleets are composed of from 10 to 25 motorships. In addition, there are at present under construction or conversion throughout the world approximately 300 motorships aggregating 1,900,000 gross tons.

Should Congress elect to continue 'pro tem' the present policy of Government operation, new vessels in adequate numbers should then be logically built, but this would undoubtedly prove a slow process requiring time. On the other hand, even with the most optimistic assumption that a liberal Federal policy be adopted such as to hasten the absorption of the present lines by private interests, the production of the necessary replacement tonnage by private owners would be even a slower matter.

While signs are not lacking that a constructive National policy will eventually emerge from the present chaos, there is always the possibility that it may take a long period of debate before it is accomplished. Therefore, it is imperative that our inferior position be ameliorated at once by using our best available vessels as a nucleus to keep our Flag alive over the Seven Seas or it will be swept off within the span of physical usefulness of our present steamers while a substantial construction program is being planned and carried out by the Board and by private owners.

To this effect, we submit as the simplest solution the immediate conversion of a large number of vessels to Diesel propulsion, even though some may opine that the results would not justify the expenditure; this, however, bears analysis.

This thorough and constructive analysis by "Marinus," a prominent naval architect familiar with the physical and operative phases of the Government's fleet, has been especially prepared for MOTORSHIP *following a careful study of shipping conditions. It brings out clearly a fundamentally sound plan for the regeneration of the Government's fleets into modern competitive units. Further articles will shortly appear from the pen of "Marinus."*

Excluding from consideration all services from North Atlantic Ports to the United Kingdom and the Coasts of Western and Northern Europe, all other Government routes are of from ten to twenty-five thousand miles per round trip, therefore, eminently suited for motorship operation. For our purposes, the vessels presently operated on these long distance routes have been segregated into the following major groups:

Service	Number of Vessels	D.W.T.
New York-West Africa..	10	82,352
Atlantic Ports-Brazil-River Plate	26	214,362
Total	36	296,714
Gulf Ports-United Kingdom and Northern Europe	24	203,443
New Orleans-United Kingdom and Northern Europe	38	381,492
Gulf Ports-Mediterranean	12	86,036
Total	74	670,971
North Atlantic-British India-Australia-Orient	31	321,033
Pacific Ports-Australia-New Zealand-Orient	36	326,689
Total	67	657,722
Grand total	177	1,615,407

The requirements of these trades naturally vary as to type, size and speed according to the nature of the prevailing cargoes, but without entering into unnecessary details, it may be broadly stated that the Board's Fleet include a sufficient number of well-built two and three-decked vessels admirably suited for all trades, and some that could be so altered at comparatively small expense.

Thus, for services of the first group there are available a number of 8,000 to 9,000 D.W.T. vessels of moderate draft capable of 12½ to 13 knots, when converted. For the second group, there are vessels of 9,000 to 10,000 D.W.T. of large cubic capacity and capable of sustained speeds of 12 knots or better, whereas for the third group, where the longer distances make higher speed more desirable, a limited number of shelter deckers of over 10,000 D.W.T. and large cubic capacity are also available, which, if operated at a reduced draft consistent with the prevailing measurement cargoes, could yield speeds approaching 13 knots.

These speeds can be obtained largely by installing engines of greater power than now fitted and partly by the use of well-known and widely adopted devices tending to reduce the appendage resistance and improve the propulsive efficiency of single-screw vessels, and entail no change whatever to the vessels' present form. A marked increase over the original speed as steamers has already been obtained with notable success by the Board's vessels recently converted to Diesel power as some have consistently averaged 12 knots or better on a number of long voyages, and this without undue overpowering.

These speeds will naturally require higher powers than if the vessels had been originally built with finer lines, nevertheless, the high economy of Diesel engines would permit these converted vessels to operate at from two to three knots better speed at only one-half their original fuel

consumption as steamers and at the same time reduce annual operating expenses by at least $60,000 per ship, thus offsetting the present operating losses and showing a profit. Taking also into account that many items entering into a conversion are unaffected by the size of engines used, this excess power can be obtained at a reasonable cost, that is about $80.00 per s.hp. Therefore, as propelling units of large power have already been developed and other attending engineering problems have been successfully overcome in the Board's first conversion program, it is logical to assume that with the same judicious selection of vessels at least equally satisfactory results can be obtained.

Once the hulls are thoroughly overhauled they might be considered as good as new, and regardless of future improvements in shipbuilding and the Diesel art, these ships as motorships could be advantageously operated for many years to come and still possess a much higher market value than new steamers built today.

As regards expenditure: while it is true that the cost of Shipping Board conversions has been somewhat higher than first estimated, they can, no doubt, be reduced by omitting unessential requirements as already demonstrated by some thrifty conversions undertaken by private interests. In fact, private shipowners have actually purchased and converted nineteen steamers to Diesel power.

As will be noted, the services we advocate for Dieselization are now manned by 177 vessels, plus a number held in reserve. It seems, therefore, that in addition to the 20 vessels already converted or recently authorized by the Board, at least 100 of these vessels could be advantageously and efficiently converted in little over two years at an approximate cost of $75,000,000, that is about one-half the cost of equivalent new domestic-built tonnage and even lower than the cost of new construction abroad.

Such a program besides providing much needed work for our shipyards, and engine plants would preserve them as an important factor of National defense and for whatever replacement policy may be adopted in the future. The resultant enhanced speed and the decreased fuel consumption and maintenance of these converted vessels would also so improve the usefulness and commercial value of these services so as to quickly place them on a paying basis and hasten their absorption by private interests.

News and Notes

U. H. McCarter Buys Yacht Josephine

The 140 ft. Diesel yacht JOSEPHINE has recently been purchased by U. H McCarter, President of the Fidelity Union Trust Company of Newark. The JOSEPHINE was built last year by the Newport News Shipbuilding and Dry Dock Co., and is propelled by two 225 s.hp. Winton Diesel engines.

Four Motorships for W. R. Grace

The first of two large motorships for W. R. Grace & Co. of New York was launched on August 15th at the Haverton Hill-on-Tees shipyard in England of the Furness Shipbuilding Co. These vessels are constructed for passenger and cargo service between New York and Peruvian and Chilian Ports via Panama Canal. Accommodation is provided on five decks for 157 first-class passengers. She is illustrated on page 757.

The SANTA MARIA and her sister SANTA BARBARA are excellent examples of modern motorvessels and will be splendidly equipped in every way. Sperry gyro compass and Sperry searchlights are fitted. The main propelling machinery consists of two single-acting Sulzer 2-stroke Diesel engines of 4,000 s.hp. each, which are intended to drive the vessel at 16½ knots service speed. For auxiliary purposes there are four Sulzer Diesel engines of 420 b.hp. each, and two large boilers; so aside from the power of the latter the total power of the ship will be 9,680 b.hp.

W. R. Grace & Co., have just ordered two 4500 tons d.w.c. combination passenger-cargo motorships from Burmeister & Wain of Copenhagen Two 2100 s.hp. Diesels will be installed.

Direction Indicators

The Direction Indicators installed on the Diesel tugs of the New York Central Railroad have given such satisfactory operation that a repeat order has been placed with Alexander McNab of New York for 16 sets of indicators to be installed on the New York Central's ferries.

New Motorship Service

The cargo motorliner MODAVIA arrived at San Francisco on Sept. 21st on her maiden voyage. She marks the entry of the Donaldson Line in the Pacific Coast-United Kingdom trade, and will carry cargo, including fruits and vegetables, which should be carried in American ships.

All Ready to Express to You

Swedish Loan for Motorships

A loan of 2,000,000 kroner has been requested from the Swedish government's Shipping Loan Fund towards the construction of the 13,000 tons Diesel driven tanker now building at Götaverken yard, Gothenburg, for the Rederi-a. b. Transoil which will altogether cost 3,200,000 kroner. It is interesting to note that a ten years' charter with foreign interests—reported to be American—has already been arranged.

Golden Gate Ferry "Golden Bear"

The Golden Gate Ferry Company's automobile ferry GOLDEN BEAR was recently completed by the General Engineering & Drydock Co. of Alameda, California. The GOLDEN BEAR is used as an automobile ferry on the newly-opened route from San Francisco to Berkeley.

She is powered by three Ingersoll-Rand airless injection Diesel engines of 450 b.hp. These are 6-cylinder units with 14 in. cylinder diameter bore, 20 in. stroke running at 265 r.p.m.

The electrical equipment was furnished by Westinghouse Electric Co. and includes two 950 hp. propelling motors. They operate at 750 volts. The three direct connected generators develop 260 kw. at 250 volts apiece.

Russian Diesel Works

The old Nobel Diesel works at Leningrad, Russia, where so much Diesel engine development work was carried on from 1898 to 1916, is now known as the Perwij Sawod Russki Diesel.

Lest You Forget

Hull Repairs to Ms. City of Rayville

The U. S. Shipping Board's Diesel freighter CITY OF RAYVILLE, operated by the Roosevelt Lines, is undergoing extensive hull repairs at Gibraltar following a collision with the French steamer AGEN.

Submarine Engines for Tugs

Seven 500 b.hp. Busch-Sulzer submarine Diesel engines will be installed in tugs by the Foss Co. of Seattle, Wash., who recently purchased these unused engines from the U. S. Navy Dept. They are of the four-cycle, reversible type, with six cylinders each.

National Safety Council Meeting

The following papers were read at the recent National Safety Council Convention held in Chicago:

"Radio's Contribution to Safety of Life at Sea" by Geo. E. Cole, Supt., Great Lakes Div. Radio Corp. of America, Cleveland, Ohio.

"Safety Education in State Nautical Schools" by Charles Williamson, Secretary, New York State Nautical School, New York City.

"The American Marine Standards Committee—The Relation of Its Works to Accident Prevention," by Col. Edward A. Simmons, Chairman of the Executive Board, The American Marine Standards Committee, New York City.

"Life and Property Conservation in Railroad Marine Operation," by O. D. Moore, Supervisor Marine Risks, Insurance Department, The Pennsylvania Railroad.

"Building Safety Into Ships," by H. E. Parker, Fore River Plant, Bethlehem Shipbuilding Corp., Quincy, Mass.

"Observations on Safety Precautions Aboard Tank Steamships" by Arthur M. Tode, Supt. Technical Div., Marine Dept., The Texas Co., New York City.

"Practical Benefits from the Physical Examination of Seaman" by Robert F. Hand, Standard Oil Co. of N. J., New York City.

"Ships—Personal Injuries" by Milton D. McIntyre. Pickands, Mather & Co., Cleveland, Ohio.

Another Atlantic City Diesel-Electric Dredge

Two 400 hp. De La Vergne Diesels and Westinghouse Electric Equipment Operate This Recently Built Craft When She Is Creating New Real Estate.

DURING the last several years a number of Diesel-driven dredges with engines of various makes have been placed in service in Atlantic City in connection with real estate and channel operations. The latest vessel of this type was placed in service in April last by the Delaware Dredge Co. of Philadelphia. She was built under the supervision of the owners and equipped by them from designs by the Chapman & Fisher Co., Inc. Her main power consists of two 400 b.hp. De La Vergne Diesel engines of the six cylinder, four-cycle airless-injection type, 14½ in. bore by 18 in. stroke, turning at 277 r.p.m. Each is connected to a 250 kw. Westinghouse d.c. generator, which in turn furnishes current to the Westinghouse 600 b.hp. 500-volt motor driving a centrifugal suction pump, and to a 60 hp. 500 volt motor driving the cutter head through reduction gear. The latter reduces the revolutions from 900 down to 18 r.p.m.

The suction pump has an over-hung propeller and this is fitted with Goodrich "cutless" rubber bearings. It operates at about 250 r.p.m. Steam for heating purposes is

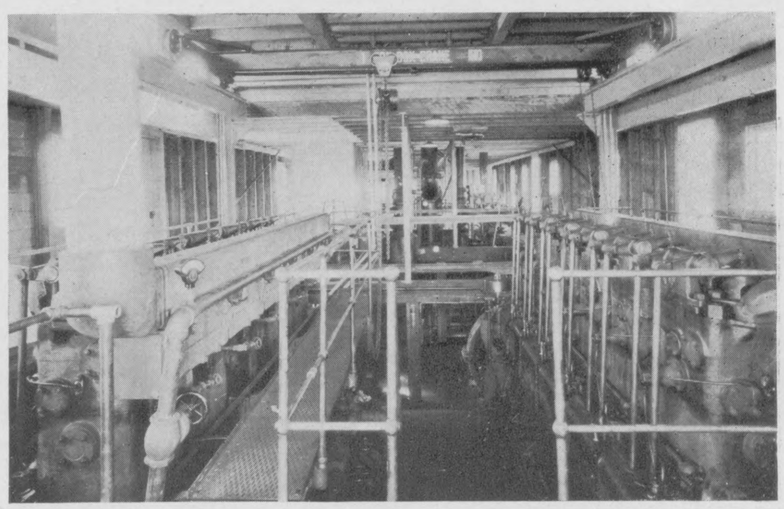
Dredge pilot house control

supplied at about 8 lbs. pressure from a Davis boiler heated by the exhaust gases from the two main engines. There is a Viking rotary pump for maintaining fuel-oil pressure for operating the boiler when the main engines are shut down. Other pumps consists of a 15 hp. electric driven 3 in. Warren centrifugal fire pump, four 1 in. centrifugal electric driven bilge pumps, a 1½ in., 5 hp. centrifugal pump for the engine cooling water and a electric-driven 1 in. centrifugal hub pump.

For auxiliary purposes there is a 35 hp. Hill Diesel engine direct connected to a generator and to an air-compressor, the latter furnishing starting power for the main engines. For overhauling the machinery there is a 5-ton Box crane equipped with a Yale block. Including 40 tons of fuel and a supply of lubricating oil, the weight of the machinery and auxiliary equipment is approximately 410 tons. The hull is constructed of wood reinforced by steel in the way of machinery foundations, and the quarters include 10 staterooms each equipped with running water. These cabins house a crew of 18. In the galley aft the range is an oil burner, but there has been installed a Frigidaire refrigerator.

The length of the dredge is 115 ft. overall, by 34 ft. 8 in. beam, 9 ft. 11 in. depth. Displacement is 670½ tons on a mean draft of 5 ft. 11¾ in. The diameter of the suction discharge is 15 in. and the capacity is about 490 cubic yards per hour.

New Diesel-electric dredge for Atlantic City. She has been giving efficient service for seven months



Engine room of dredge showing two 400 b.hp. Diesels in foreground. The electric generators are at the after end

McNab Marine Appliances

For many years McNab products have been known in shipping circles all over the world. McNab equipment, including the Bethlehem-McNab-Vista system of propeller shaft lubrication has been fitted to a large number of motorships, including all the Standard Transportation Company's canal tankers, four of the Shipping Board's conversions and the U. S. War Department's Diesel-electric dredges.

This system of shaft lubrication is described and illustrated in their new catalogue, which is published by A. McNab. Among other McNab equipment pertainable to motorvessels is that of the Ford torsionmeter for Diesel engine ships, the Willet Bruce automatic whistle control, McNab direction indicators, dial-o-meters and revolution counters. Readers of MOTORSHIP may receive a copy of this book by writing directly to Mr. Alex. McNab, 1 Broadway, New York, N. Y., who also is agent for the Siemens pyrometer.

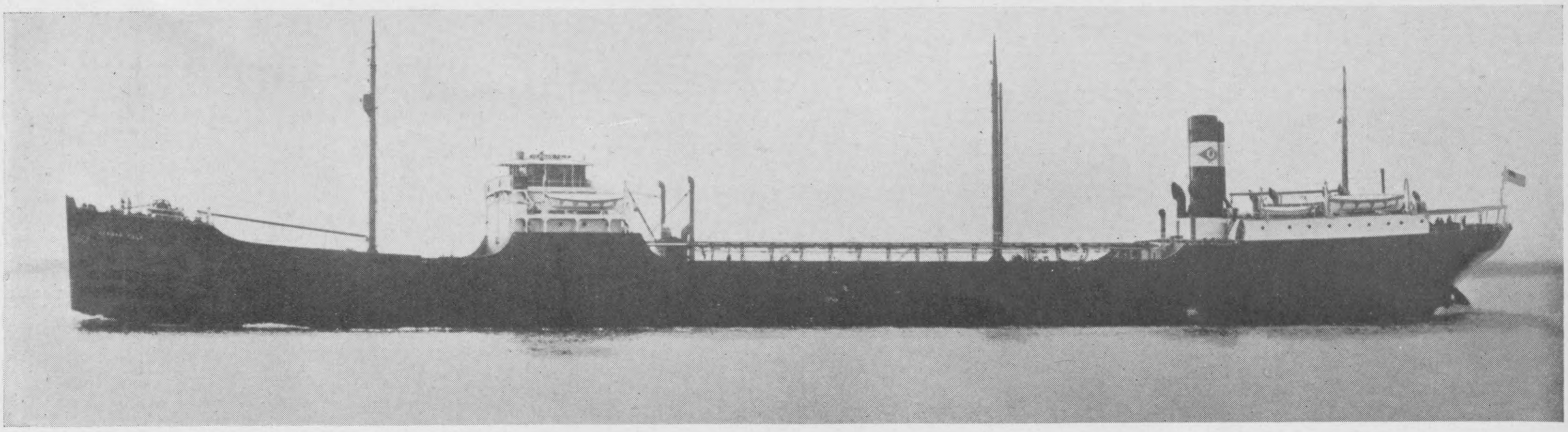
Modern Diesel Practice

An interesting paper covering experiences with 2 and 4-cycle type Diesel engines using both air and airless systems of fuel injection, was read by A. C. Estep, Chief Diesel-Engineer of the Washington Iron Works, Seattle, at the Seattle Regional Meeting of the A.S.M.E. on August 29th.

According to Mr. Estep's investigations of oil engines now being manufactured, and oil engines recently placed in service, the trend is now towards the airless injection principle. A point raised by Mr. Estep is that the practice of comparing unlike types of Diesel engines with unlike fuel-injection systems on a common, apparent brake m.e.p. basis is very misleading and does not give the engine of high mechanical efficiency an even break.

Heat Transmission

A valuable contribution on heat transmission in Diesel engines has been made to the August, 1927, issue of the Journal of the American Society of Naval Engineers, Washington, D. C. by Lieut. Wm. Wakefield, U. S. N. The article is of special interest to oil engine designers.



Former Shipping Board Tanker Herman Falk now equipped with Falk engines

Geared Oil Engine Drive Replaces Steam

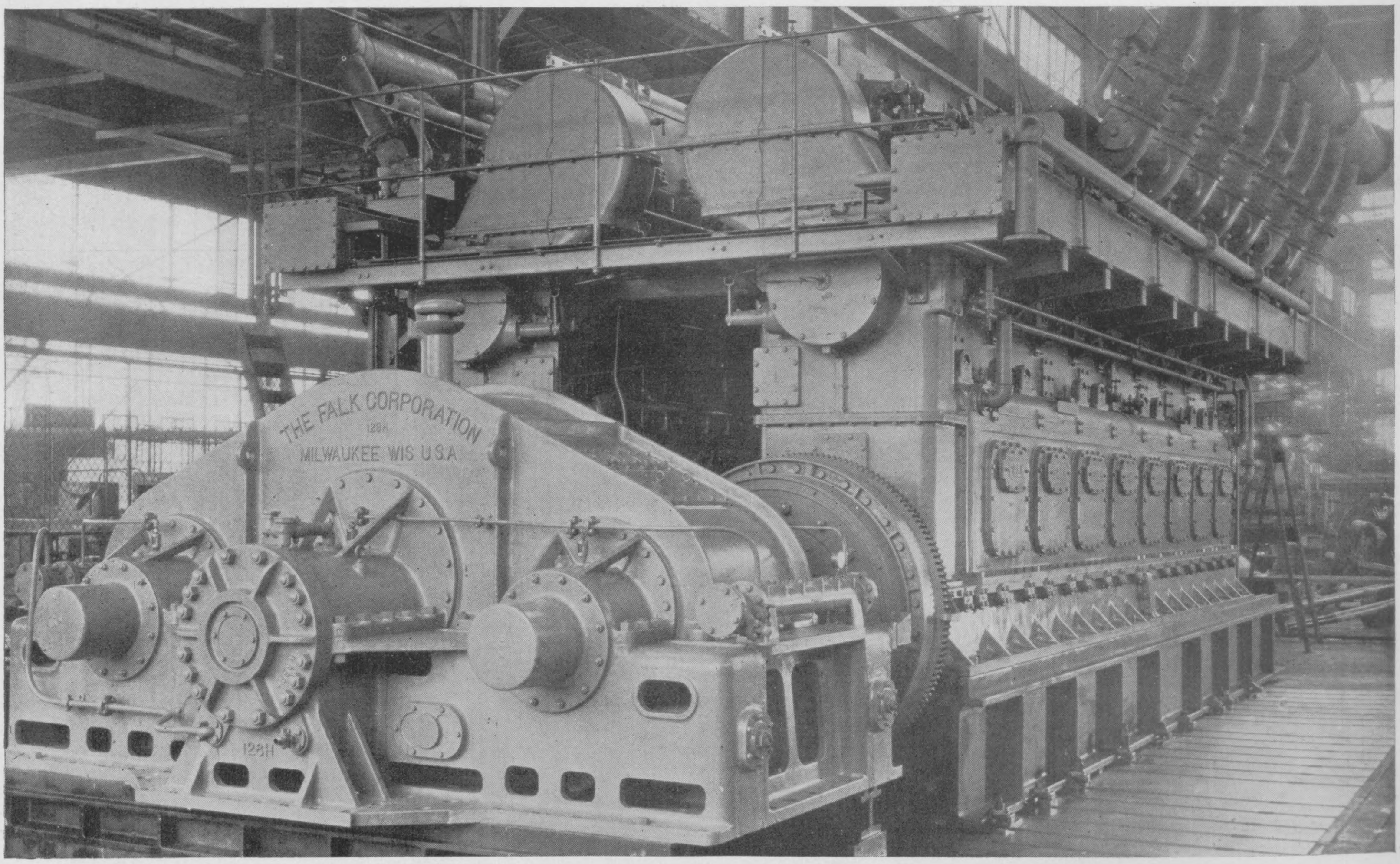
Complete Engineering Details of the Herman Falk Are Given for the First Time

EMBODYING a number of novel and noteworthy engineering features after nearly seven years intensive development work, the recent conversion of the 10,200 tons d.w. tanker HERMAN FALK, ex-Tuxpanoil to Falk geared oil engine drive should be of great interest to American shipowners. No doubt the installation will also be regarded with interest abroad because of the geared Diesel ships completed and now being built in German Shipyards. This vessel was briefly discussed in our September issue and we are now enabled to place complete and exclusive information before our readers.

It will be recalled that the first complete Falk geared oil-engine plant ran tests late in 1922 and was fully described and illustrated in the Special Falk Supplement to MOTORSHIP issued in May 1923. That unit consisted of four 550 b.hp. Diesel engines geared together and must not be confused with the tanker installation which is entirely new and consists of two 1300 b.hp. Falk engines and reduction gears. The original set was found so economical that it has been retained to run the builders' power plant. This, of course, has given the designer valuable assistance in studying the operation of the geared-Diesel unit under working conditions at close hand.

The HERMAN FALK—which has already completed several voyages with her new power was built by the Baltimore Drydock and Shipbuilding Company, Baltimore, Md., in 1921 and was originally propelled with 2600 s.hp. Parsons' gross compound turbines and Falk double reduction gears, steam being furnished by 3 Scotch boilers fitted for burning fuel oil under forced draft.

In 1926, the Oil Transport Company of Baltimore purchased this vessel from the Shipping Board with the stipulation that the original propelling machinery would



The Falk 2600 s.hp. geared oil-engine unit makes a very compact ship's power plant

be replaced with a Diesel plant, and the necessary alterations be performed in such manner as to entitle the vessel to the highest classification by the American Bureau of Shipping for vessels of her age and type. They changed her name to HERMAN FALK, after the president of The Falk Corporation, builders of her new engines. The conversion work was carried out by the Bethlehem Shipbuilding Corporation under the direction of Chas. R. Ross, naval architect, who planned the installation.

The registered dimensions of the HERMAN FALK are:

Deadweight	10,200 tons
Length	431.0
Breadth	59.2
Depth	33.4

fer from that of the sister ship DISTRICT OF COLUMBIA.

1 Steam duplex bilge pump, 6 x 5¾ x 6 in., Worthington.

1 Steam duplex sanitary pump, 6 x 5¾ x 6 in., Worthington.

3 Steam duplex fuel oil pumps to boilers, 5¼ x 3½ x 5 in., Worthington.

2 Steam simplex feed pumps to boilers, 12 x 8 x 24, Worthington.

1 Steam steering engine.

1 Steam driven refrigerating machine Frick 2 ton, driven by 5½ x 7 engine.

1 Steam driven Howden fan blower, driven by Sturtevant engine, 7 x 6.

1 Steam duplex fire pump, 12 x 8 x 14 in., Worthington.

2 Steam duplex lubricating oil pumps, 7½ x 7¼ x 10, Worthington.

1 Centrifugal cooling water pump, Allis Chalmers, 750 gal. per min., 5 x 5, driven by General Electric 25 hp. motor.

1 De Laval lubricating oil purifier, No. 900, driven by 5 hp. motor.

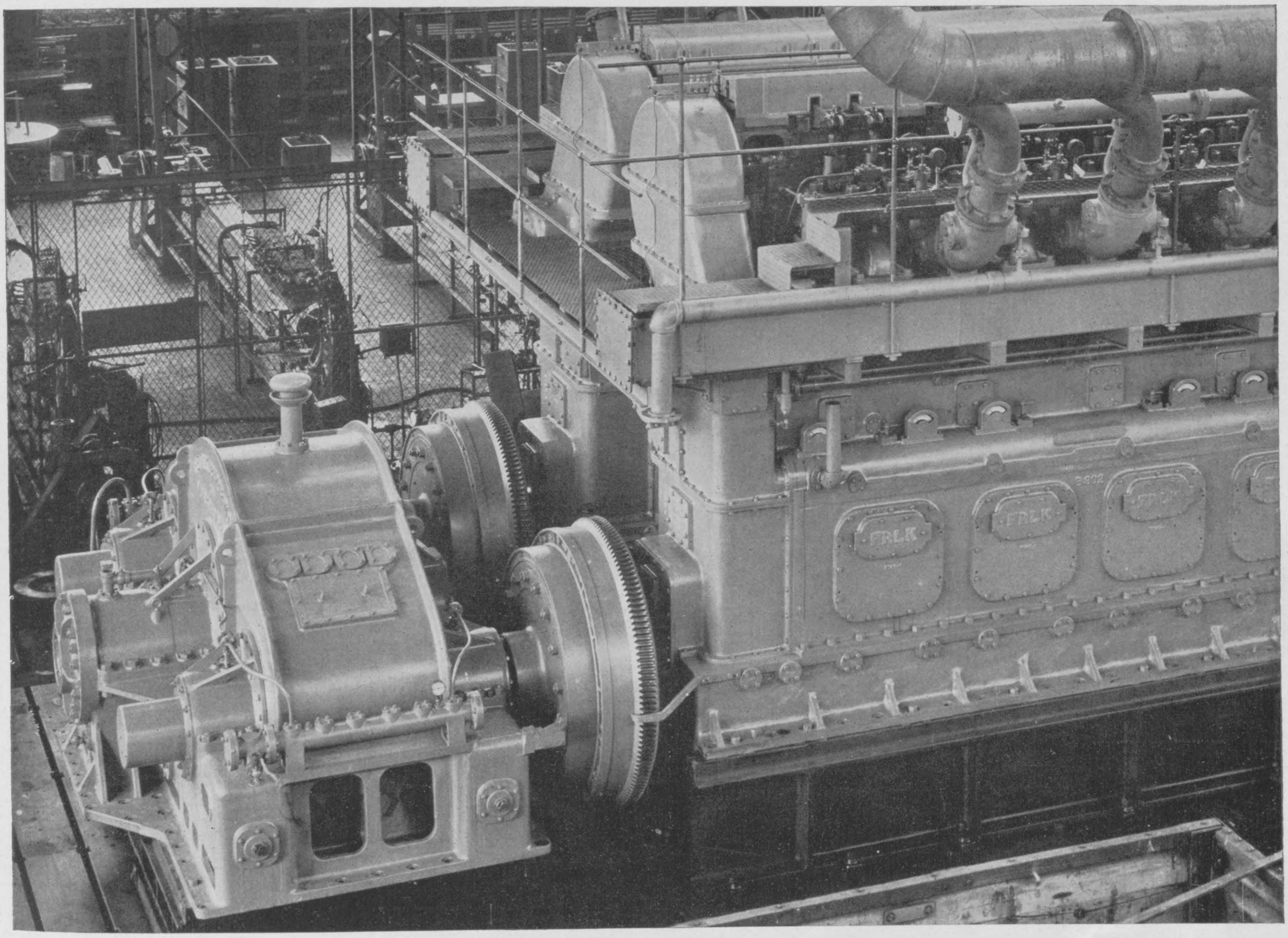
1 De Laval fuel oil purifier, No. 600, driven by 5 hp. motor.

2 Steam driven air compressors, Rix. two-stage, 8 in. x 6 in. x 3½ in. x 6 in., driven by one 7 in. x 7 in., 25 hp., American Blower engine.

1 Steam driven condenser circulating centrifugal pump, 10 in., Morris Mach. Works, driven by 8 in. x 10 in., reciprocating engine.

1 Oil engine fuel feed pump, 4½ in. x 2 in. x 4 in., Gardner.

1 Steam duplex, 5¼ in. x 3½ in. x 5 in., Worthington pump for the fuel-oil purifier.



Very little space is occupied by the reduction gear unit at the forward end of the two main engines. Propeller shaft runs aft between the engines

A point of particular interest is that this vessel is a sister ship to the tanker DISTRICT OF COLUMBIA now being converted to Diesel-electric drive by the Standard Oil Co. of California. Performances of the two ships in similar services will offer plenty of opportunities for comparisons of the advantages of the two types of propulsion.

It was found expedient, by reason of the heat required for the cargo prior to pumping and by reason of the large capacity steam pumping machinery on the vessel, to retain two of the original boilers; and, therefore, part of the original steam machinery was retained

In this practice the conversion will dif-

1 Steam duplex fuel oil transfer pump, 7½ x 6 x 10, Worthington.

2 Steam driven (reciprocating engine) 15 kw. Generator Electric generators.

Windless, capstan and deck winches.

New auxiliary machinery was supplied and installed as follows:

1 Falk auxiliary oil engine, 3-cyl., 4-cycle, 12 in. bore and stroke, 165 b.hp., airless injection, 450 r.p.m., direct connected to a 110 kw., 110 volts, d.c., General Electric generator.

1 Scavenging blower, Sturtevant No. 5, 14¾ x 14¾ discharge and 22 in. suction, driven by a 75 hp., 110 volts, General Electric motor.

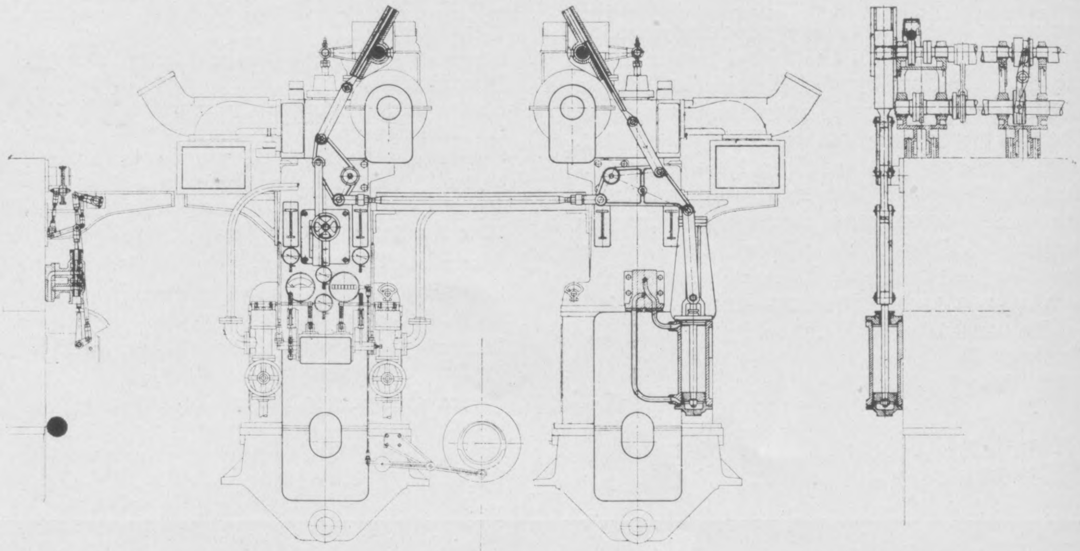
1 Lubricating oil pump, Schutte & Koerting, geared 250 gal. per min., driven by General Electric 10 hp. motor.

The original turbines with their foundations and the center boiler, together with its supports, were removed and new foundations installed for the Falk engines and reduction gears. No changes were necessary in the structure of the vessel and all bunker spaces, pump rooms and cargo spaces were maintained as originally.

No changes were made in the diameter of the line shafting or the propeller shafting. However, by reason of the location of the thrust, two additional lengths of shafting were necessary and these were installed of the same diameter as the balance of the shafting. The original propeller was also used again without alteration.

In addition to the installation of the new

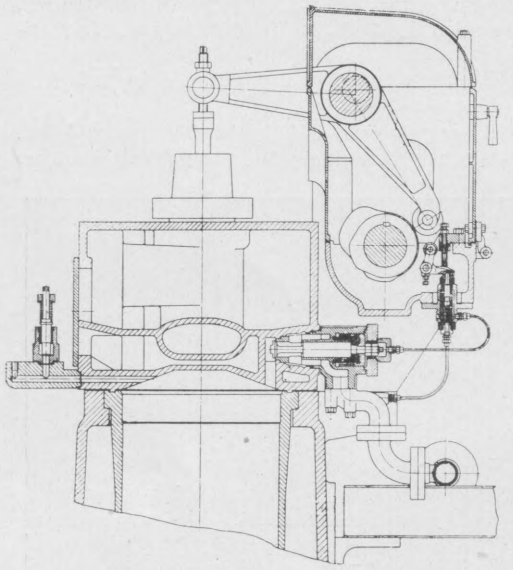
machinery and auxiliaries, the vessel was thoroughly overhauled. The steel steam pipes for deck use were all renewed of copper, and the vessel was scaled and painted throughout and a number of other items carried out.



Arrangement of the controlling and reversing mechanism

The Main Engines

The interest naturally centers on the propelling plant, which consists of two 8-cylinder 18″ bore x 22½″ stroke 4-cycle airless injection Falk oil engines, each



Valve operating mechanism

rated 1325 B.H.P. at 275 R.P.M. which are arranged parallel on each side of the ship's center line. Unquestionably they incorporate some splendid engineering.

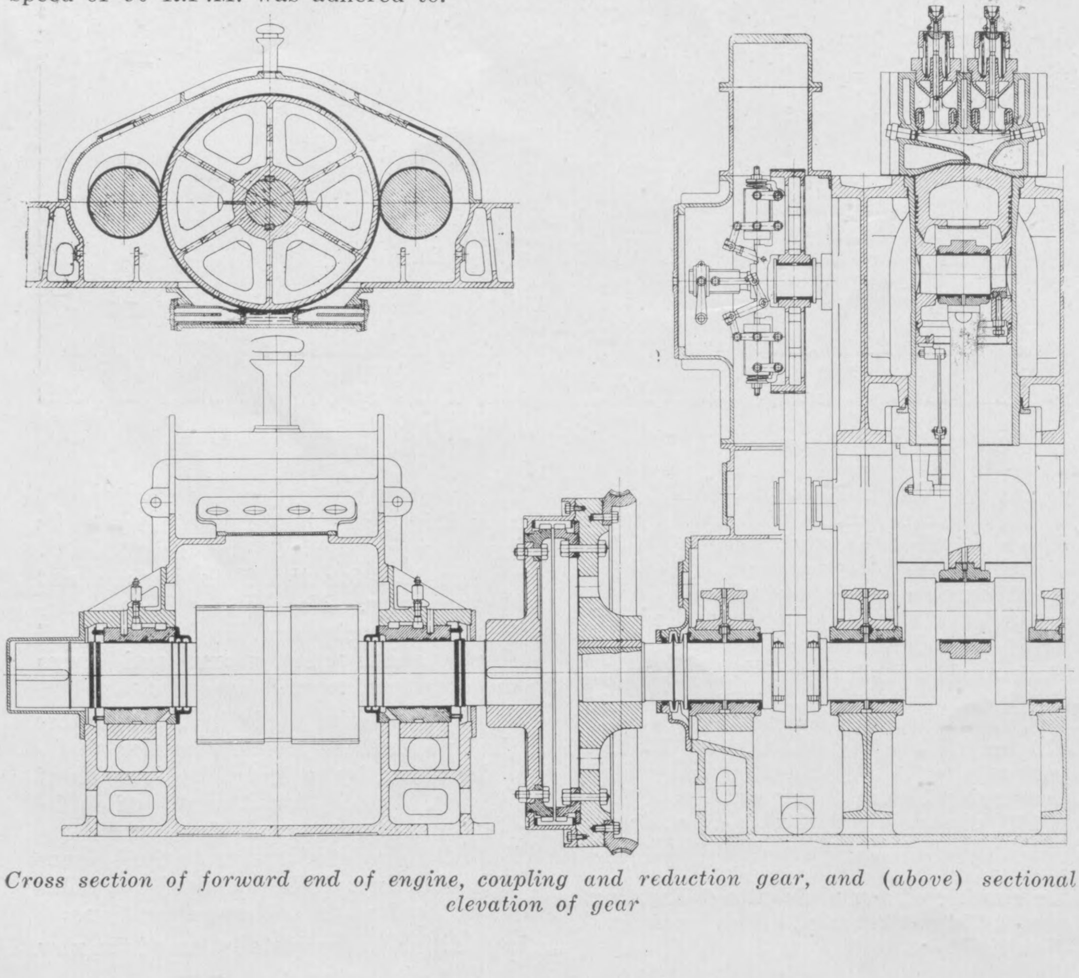
Their crankshafts are connected by means of Falk flexible couplings to two pinions which mesh with one common low-speed gear. The center lines of the two crankshafts, the two pinions, the low speed gear, and the intermediate shafting are all in one plane. The original propeller speed of 90 R.P.M. was adhered to.

The principal dimensions of the power plant are as follows:

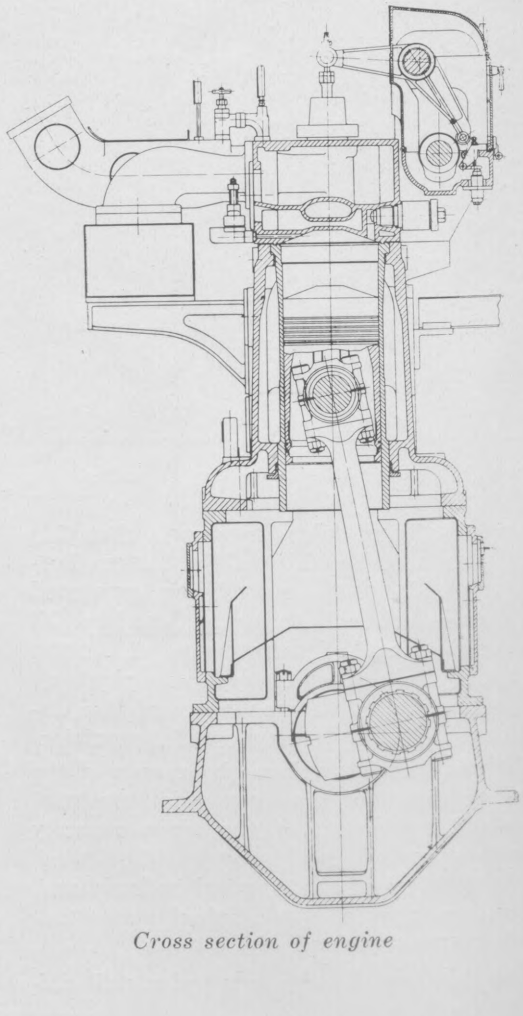
Height above center line of crankshaft	11 ft. 6 in.
Depth below center line of crankshaft	32 in.
Overall length of engine including gear unit	39 ft. 1½ in.
Overall width over base plate flanges	14 ft. 1 in.
Face width of gears	30 in.
Net width of teeth	25 in.
Diametral pitch	2 D.P.
Pitch circle diameter of low speed gear	76½ in.
Pitch circle diameter of pinions	25 in.
Angle of teeth	30 deg.
Number of teeth—gear	153
Number of teeth—pinions	50
Diameter of crank main bearing pins	10¾
Diameter of low speed gear bearings	15 in.
Diameter of pinion bearings	12 in.
Diameter of line shafting	12⅝ in.
Diameter of tail shaft	14⅛ in.
Diameter of propeller	17 ft. 9 in.
Pitch (4 blades)	13 ft. 3 in.

The unit engines are of the standard Falk type, using their typical flat spray, airless injection, compression chamber design of the cylinder heads.

Structurally, the engines are divided into the baseplate containing the crankshaft, and the cylinder block containing the liners, both parts connected by the columns. The columns are simply two plates with I-beam reinforcements at the main bearings and large crankcase doors between them. Base plate, columns and cylinder block are split in the plane between cylinders 4 and 5. All these parts are made of cast-iron with generous cross sections, as it was thought best not to sacrifice weight, and in order to hold deformations to a minimum. The working of this idea may be explained by the fact that with an engine length of 27′-10⅝″ measured over the finished faces at the ends of the bedplate, the vertical



Cross section of forward end of engine, coupling and reduction gear, and (above) sectional elevation of gear



Cross section of engine

movement of the top of the cylinder block due to the inertia forces at full speed was calculated to be 0.0035″.

The shaft is machined out of one forging; the cranks are set for complete balancing of the inertia forces and moments of the first and second order. The main bearing shells are of babbitted cast-iron and can be rolled out easily. Splashers over the cranks prevent lubricating oil from being thrown into the cylinders.

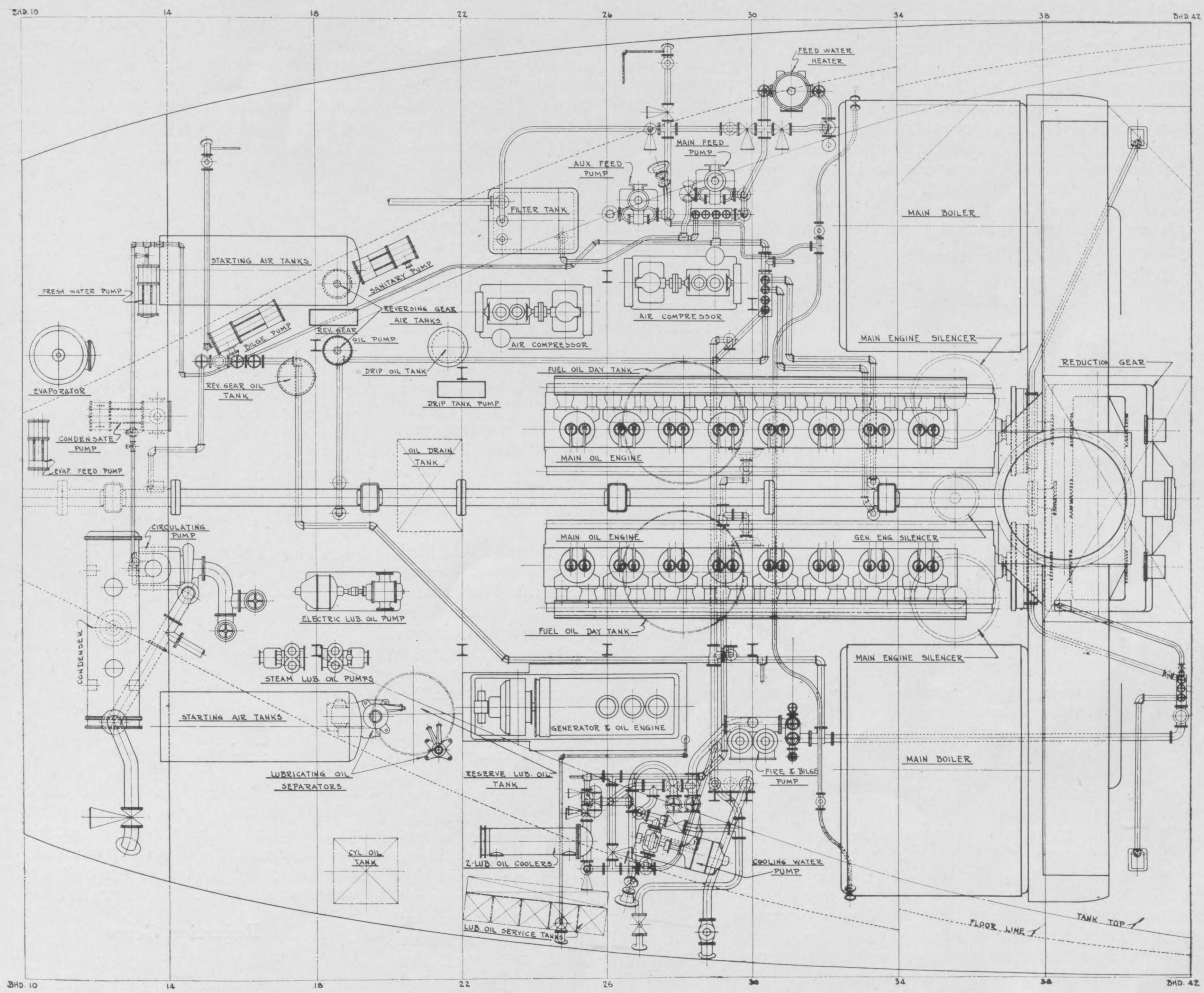
The crankshafts are connected to the

be moved and when the starting levers are in operating position the reversing lever cannot be moved. The fuel control lever is left free to be moved at any position of the other levers. This is distinctly different from the air-injection Diesel engine, where the fuel can only be turned on after the injection air has been turned off. The Falk engine, being of the airless injection type, permits the setting of the fuel control lever at about 30% power when starting up, thus insuring that practically with the

It will be admitted that, for a 2600 H.P. engine this is a very small consumption. A fuel consumption as low as this is remarkable.

Reversing Mechanism

The next important feature of the engine is the common reversal. The two engines are started simultaneously so that severe reactions on the gear teeth are avoided. If one engine should be a little ahead of the other one with its piston thrust, this



Engineroom plan of Herman Falk showing main Diesel engines, reduction gears, two auxiliary boilers, the old steam auxiliary equipment and the new Diesel-electric auxiliaries

pinions by means of special Falk flexible couplings. The degree of rigidity of these couplings and also the masses of the comparatively small flywheels were selected so as to place the two-noded criticals most favorably. The flywheels proper are practically not much more than rings for the barring gear. This barring gear was not erected in its place in the shop; therefore, it is not visible on the pictures.

The camshaft drives of the two engines are arranged toward the gear end. The engine's control stand is arranged on the port side and the reversing machine on the starboard side.

Reversing and starting levers are interlocked, so that in stop position of the reversing lever the starting levers cannot

first revolution the engine begins to fire. The result of this operation is not only assuredness of the starting maneuver, but also a saving of starting air. In spite of the fact that only two air receivers of 4′3″ diameter x 11′7½″ length are fitted in the ship, the following readings were taken by the American Bureau representative when both tanks were pumped up to 350 lbs. and then shut down:

Ahead		Astern	
350 lbs.	1st start	335 lbs.	1st start
323 "	2nd "	313 "	2nd "
300 "	3rd "	292 "	3rd "
285 "	4th "	275 "	4th "
270 "	5th "	265 "	5th "
260 "	6th "	254 "	6th "
237 "		243 "	

would simply mean that it would exert a somewhat larger power on its side of the low speed gear, the other one coming a little later, but as the crankshafts of the two engines are kept in a constant relative position by the main gear, it is obvious that the low speed gear cannot be thrust forward or backward by such an action and it is only the oscillation of the low speed gear which can damage the teeth.

This explains the remarkable fact that the gear drive operates perfectly smoothly and noiselessly even in case one engine delivers considerable more power than the other, or one is entirely disconnected and only one driving.

The reversing mechanism is illustrated

on page 766 and consists of a vertical cylinder, operated by means of compressed air, which actuates a system of links, levers and racks that simultaneously shift the crankshafts in the desired position. A locking arrangement is provided to hold the piston quiet when the engines are in continuous operation.

The diagram of this movement reproduced herewith shows that a full rotation of the rocker or fulcrum shaft is necessary to bring about a reversal of the engine. The reversing action is done by first lifting the valve rockers from the ahead cams, then shifting the cam shaft and after that lowering the rockers down on the astern cams. One-third of the rotation of the fulcrum shaft is used for lifting the valve-levers, one-third for cam shaft shifting and one-third for setting the levers. A hand reverse gear is provided on each fulcrum shaft.

As already stated, the engine is of the airless injection type and uses two flat sprays fitted in a special chamber adapted

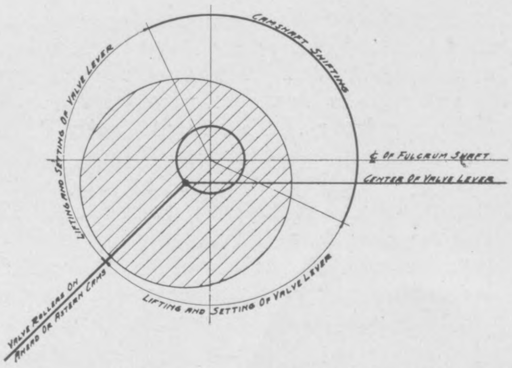
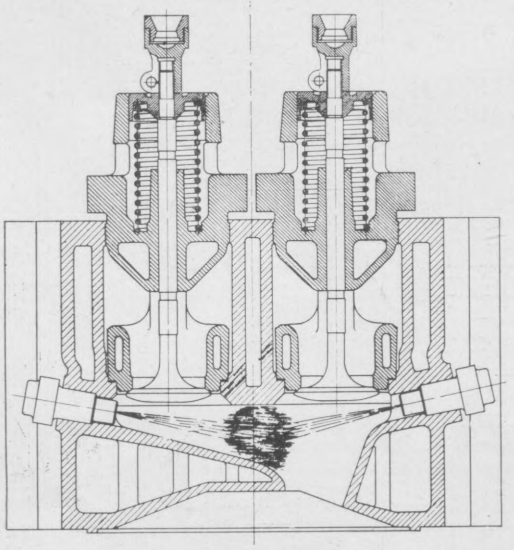


Diagram of reversing motion of fulcrum shaft



Section through cylinder head showing combustion chamber and valves

in the cylinder head. A spray in action is illustrated on the next page.

The spray tips develop a flat spray of great penetration and fine atomization. Three holes meet in a common plane in a small oblong cavity. By carefully selecting the diameter of the holes, the angles and the dimensions of the cavity, any strength of penetration and any amount of atomization can be obtained. The sprays issuing from these nozzles meet at the inner side of the throat which connects the compression chambers with the piston space. At the meeting point a cloud of fuel is produced right at or very shortly after dead center. When the piston descends, this cloud of fuel rushes into the piston space, meeting the pure air contained in the compression space. Thus a rapid combustion is effected right in the throat and in the piston space which burns the fuel completely within the first part of the power stroke. The seats of the exhaust valves are cooled; the intake valve cages are duplicates of the exhaust valve cages so that they may be interchanged, but they are not cooled. The method of combustion, as explained above, is new and covered by a number of patents.

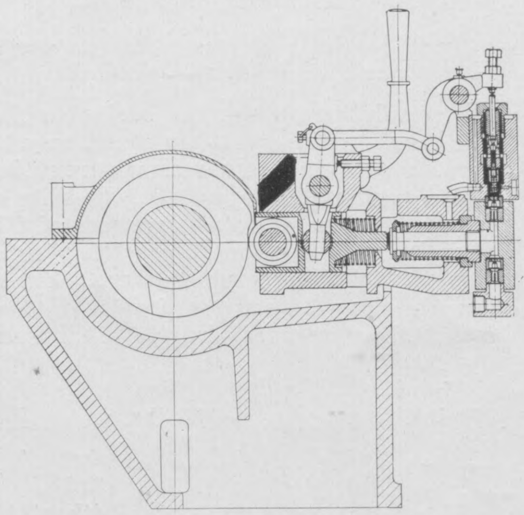
A new arrangement of the fuel injection pumps has been introduced. On the center line between two cylinder heads on a strong bracket projecting from the cylinder block, there is mounted a cam shaft bracket with two bearings for the cam shaft. Between the two bearings are located the fuel-injection cams and the injection pump.

Each engine is also fitted with an independent governor which acts upon the pumps of its engine entirely independent of the governor of the second engine. Thus, when the propeller is out of the water in a heavy sea and if the engines race, each governor will cut out its own engine.

It will be necessary to adjust the two governors properly, but no special accuracy will be required since the engine speed goes up beyond the speed at which each governor cuts out the fuel supply completely. When the propeller dives back into the water, the load increases so suddenly that a little difference in timing of the two governors has no influence whatever.

The lubrication of the engine is divided in two parts, the cylinder lubrication and the crankcase and camshaft lubrication. The cylinder lubrication is effected by means of two 16-feed Manzel lubricators located at the free end of the engine on the cylinder block. These lubricators are driven by means of levers and rods from the camshaft.

Engine lubrication is effected by means of a pressure system, the oil being forced into two pipes attached to the base plates right at their top. These two pipes can be clearly seen on one of the photographs, where they are easily identified by means of the two gages set on them. These pipes are very strong so that in an emergency they can be used as supports for parts taken out of the engine. At the ends of these two headers, a pipe leads up to the camshaft which feeds oil to all of the

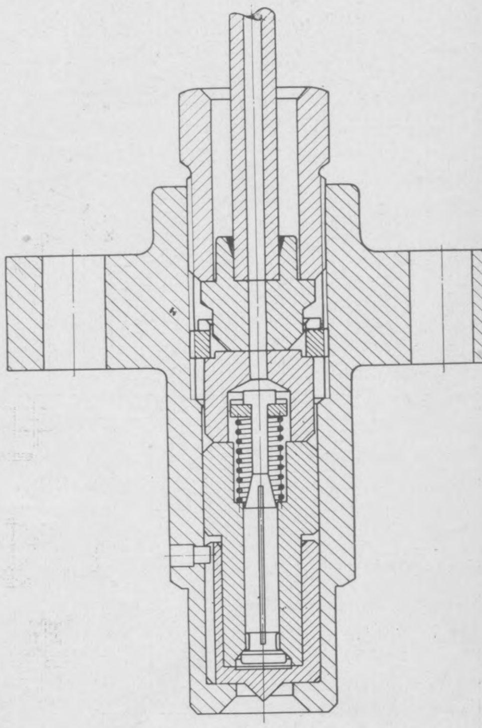


Cross section of fuel pump

camshaft and the valve rocker and fulcrum shaft bearings. It is worth while mentioning that the cam rollers are also supplied with pressure oil.

Hand lubrication has been reduced to a minimum. All the bearings of the pinions and the low speed gear as well as the single-collar thrust bearing are connected to the lubrication-oil pressure system. An electrically driven gear-pump has been provided to supply the lubricating oil, and the two existing Duplex steam pumps and the existing oil coolers of the old steam turbine drive have been retained. A new electrically-driven centrifugal cooling-water pump has been installed, as a reserve to which the existing fire and bilge pump should be added.

A feature new to marine Diesel engines is the fitting of Motometer distance thermometers to all main bearings. The Motometers are installed in special cast-iron housings on the engine crankcase where they can plainly be seen, but not easily damaged. These simple instruments enable the temperatures of the bearing babbitts to be watched at all times. There are 32.

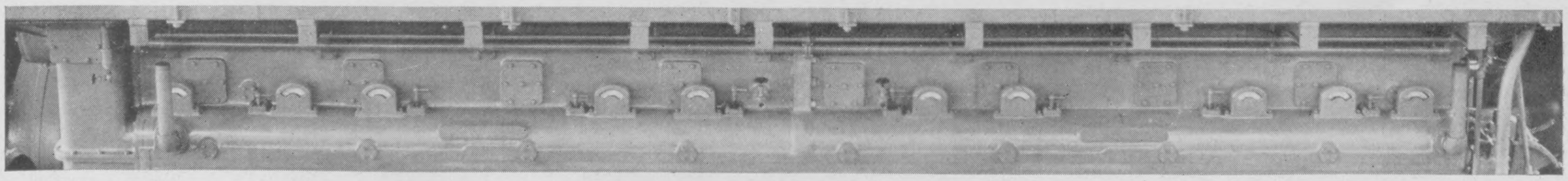


Fuel injection valve

Reduction Gears

The gears of the HERMAN FALK differ considerably from the usual marine reduction gears, as they are of the rolling-mill type with stub teeth of rather coarse pitch lubricated by a semi-fluid Crater compound, whereas the gears used in Germany by Vulcan, and, by Blohm and Voss are of the turbine reduction type with fine pitch and oil spray lubrication.

Due to the mean tooth speed being only 1800′ per minute, there is no reason why the cumbersome spray lubrication, with its attendant system of piping, oil coolers, force feed and circulating pumps, should not be dispensed with, with consequent reduction of first cost, upkeep and simplified operation. Doubtless the favorable performance of the first reduction gear built for experimental purposes by The Falk Corporation must have influenced the builders as regards the adoption of this



A new feature of marine oil-engine design is shown in the application of Motometers, in special housings on the engine frame, with connections to the main bearings for reading bearing-metal temperatures

type of lubrication, as the tooth wear of this first set has been only 1/1000" after over five years' continuous operation in the builders' own power house. On this basis it is confidently anticipated by the builder that the HERMAN FALK gears will outlive the ship.

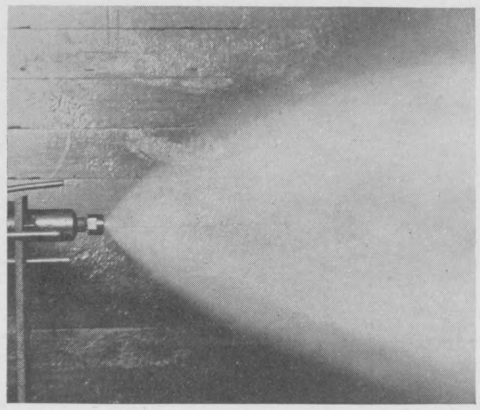
The short length of the pinions in proportion to their diameter has also permitted the elimination of the usual middle bearing thus materially reducing the length, cost and torsional deflection.

As already stated, the gears are lubricated by means of Crater compound and the bearings by means of pressure oil. A carefully designed system of baffles prevents the contamination of either oil by the other.

It should be mentioned that the pinions are solid forgings whereas the slow-speed gear is a steel casting secured on a forged shaft. As can be inferred from the illustration, the gear unit is quite narrow and its sub-base is structurally strong. Thus, the gear is capable of resisting any deformation due to working of the ship's structure. The gears are quite silent in operation—in fact, remarkably so.

Torsional Vibrations

An extremely important point with gear-Diesel drives is the control of critical speeds so that these may be made to occur below and above the operating range. Also the unavoidable intermediate criticals should be unimportant and of such frequency and amplitude as not to induce chattering of the gears and severe torsional stresses on the shafting.



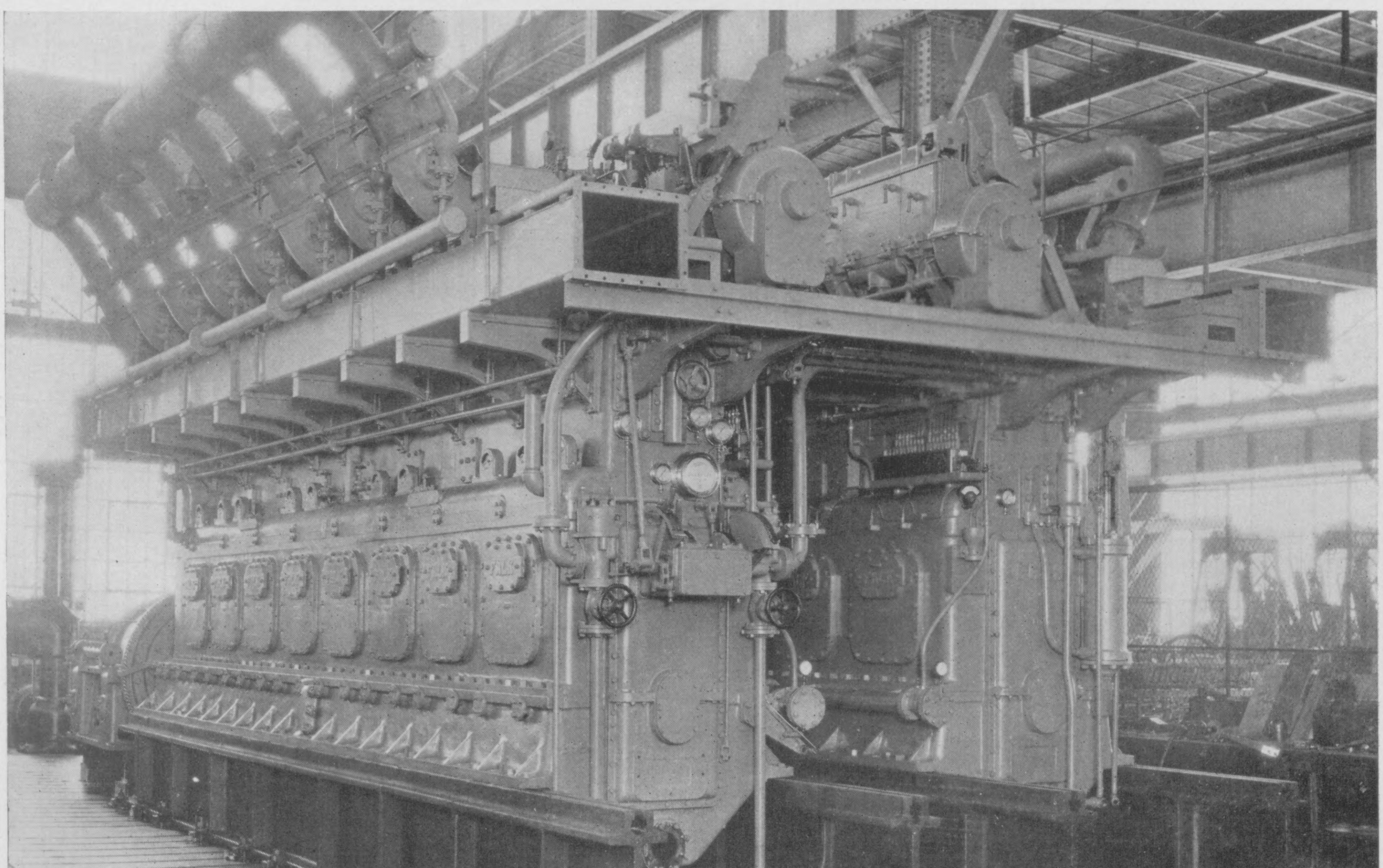
Testing a Falk fuel nozzle. The spray is flat

In the case of the HERMAN FALK, the original turbine installation was arranged so that the gears were located abaft of the turbines thus resulting in an extremely short connection between the gear unit and the propeller. With the new arrangement instead the gear unit was placed near the forward bulkhead thus permitting two additional sections of intermediate shafting.

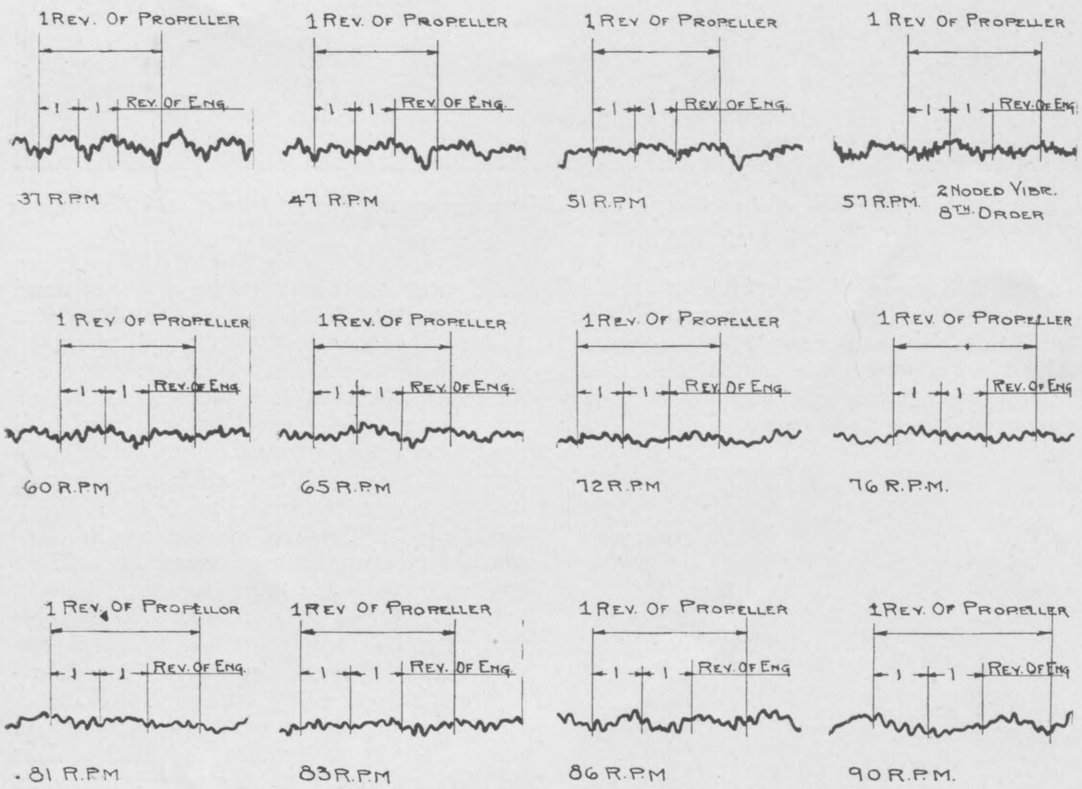
In the one-noded vibration, the combined engine and gear masses swing against the propeller mass and the latter being given, its frequency can only be influenced by changing the flywheel masses or the line-shaft diameter, because gears as well as engine masses are more or less standard and not subject to variation. As the result of the arrangement adopted, the one-noded natural frequency has its fourth order critical at 15 propeller R.P.M. and, even allowing for a wide reach, they can never run in it because the engine does not fire regularly at any speed below 25 R.P.M.

The two-noded vibration is mainly an engine vibration and means to shift it are not many. The eighth order critical of the two-noded natural frequency was figured to be at 58 propeller R.P.M. It has actually been found to have its largest amplitude at 57 R.P.M.

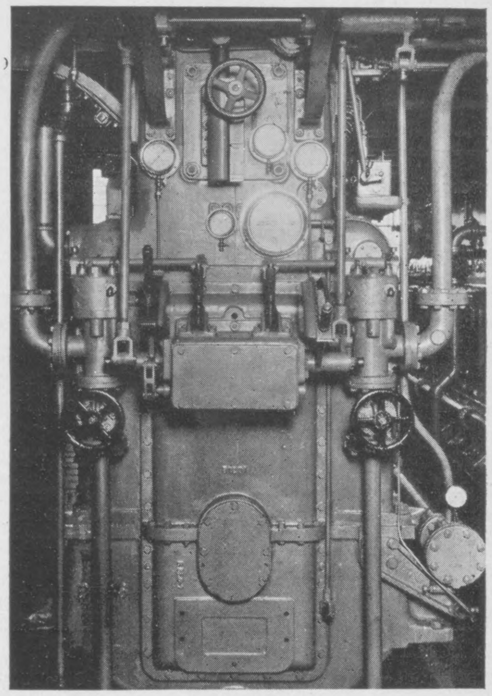
The 5½th order critical of the two-noded natural frequency occurs at about 83 revolutions, a speed which is very much used in the operation of the ship. Under or-



After end of Falk twin geared oil-engine unit installed in ex-Shipping Board tanker



Torsiograms taken during first voyage of the Herman Falk



After end of engine

dinary circumstances, it would have been necessary to exclude this speed from the operating range and, in order to avoid this inconvenience, the firing order of the engines was arranged so as to reduce the amplitude of the vibration to a minimum. This attempt has been entirely successful as the torsiograms do not reveal any trace of this vibration at 83 revolutions.

The three-noded vibration is characterized by an oscillation of flywheel against gears and simple and effective means can be used to shift it; in this particular system the available means are variation of the flywheel masses and stiffness of the coupling springs.

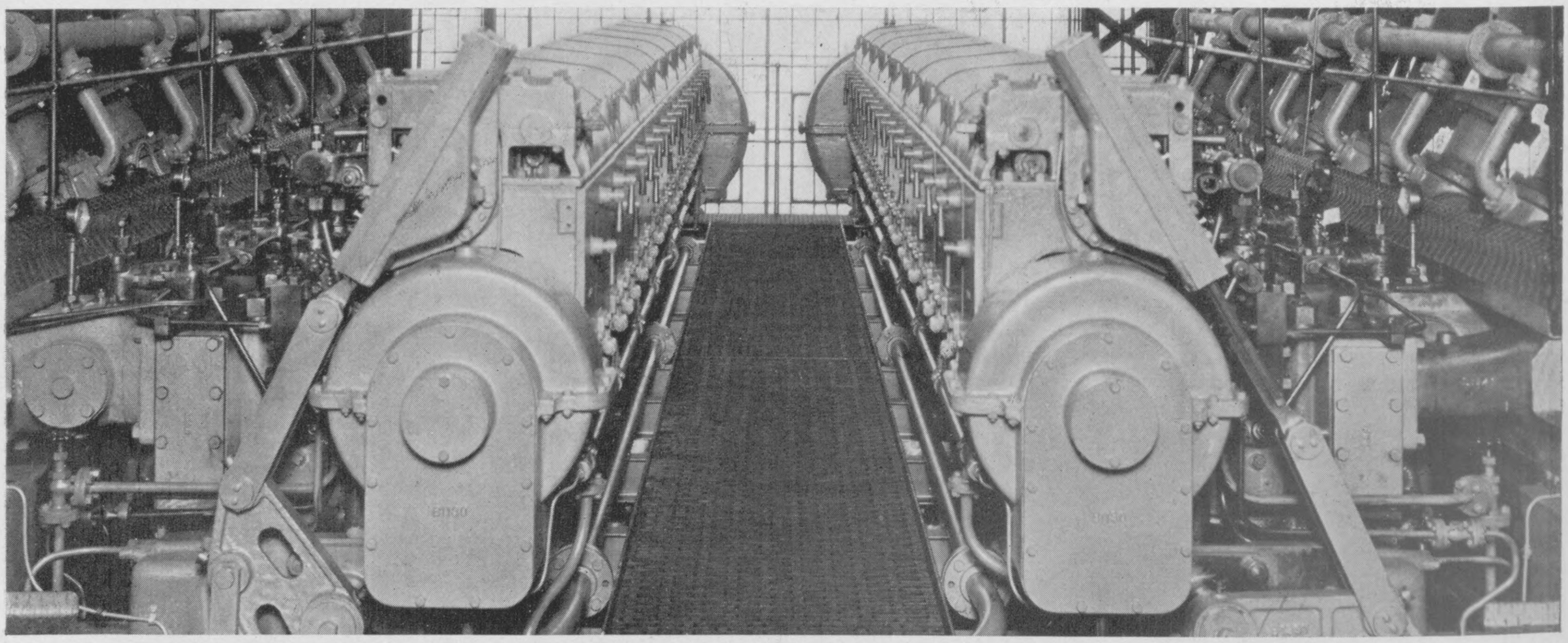
The three-noded vibration has 2780 vibrations per minute. Its basic critical, of the eighth order, occurs at 348 engine or 114 propeller R.P.M. With the flywheel masses originally provided and Falk flexible couplings dimensioned for safe transmission of the torque, it was found that this critical occurred at 100 propeller revolutions. This was considered extremely unsafe, because being a basic critical it might reach into the operating speeds. By cutting down the flywheel masses, it could be raised only to 101 revolutions, but when the flexible coupling was fitted with springs of the old thickness but greater width, raising the stiffness about 30% over the standard, the basic critical was shifted to 114 R.P.M. which was considered safely beyond the maximum speed of the propeller, even when it should suddenly emerge out of the water in a heavy sea.

The torsiograms reproduced herewith were obtained during the vessel's initial Southbound voyage in the Gulf of Mexico and were taken on the line-shaft immediately abaft the coupling flange of the low speed gear.

As previously explained, the fourth order critical of the one-noded vibration (180 vibrations per minute) occurs at 15 propeller revolutions. Even assuming a wide range for this vibration, it is not possible that the engines will ever run in it because it is always passed too quickly when starting or shutting down.

The two-noded vibration is important, the frequency of which was calculated to be 1416 vibrations per minute. As there are four power impulses during each engine revolution at all speeds, the 8th order critical of this vibration should occur at 117 engine or 57.7 propeller revolutions, but from the 57 revolution torsiogram it is evident that eight vibrations actually occur during every engine revolutions. Thus, every second natural vibration of the physical system coincides with one firing impulse. This is the only critical which has to be excluded during operation, its reach, however, is quite small as all speeds outside of the range of 52 to 62 revolutions of the propeller are free from vibrations.

Usually a critical gives notice of its presence by a rumble in the gear case and a



View of cylinder heads, valve gear and exhaust manifolds

chatter in the flexible couplings, but during the trials no such noises were heard even at 57 revolutions. This is due to the fact that the couplings and especially the gears are in the anti-node of the vibration as danger exists only when either one is in or very near to a node.

It is sometimes difficult to find the actual critical speeds from the torsiograms due to the fact that there is always a certain "reach" up and down of the criticals, so that it becomes necessary to determine the speed at which the widest amplitude occurs from the torsiograms taken at different speeds in order to find the actual critical speeds.

At some speeds, faint hints of vibrations can be discovered which are of such small magnitude that they cause only negligible stress variations in the shafts. It is remarkable how small the actual amplitudes of the critical vibrations are, and more remarkable even that no other criticals have been discovered, and the latter affords a conception of the good engineering incorporated.

Weight and Cost

Complete figures on weights and costs of a new installation are usually difficult to obtain. For the interest of our readers we are, therefore, privileged to publish with permission of the Owners, the following interesting information:

	Pounds
The weight of the two main engines, including two flywheels with couplings, one complete reduction gear unit, one twin car ring gear, platforms, intake and exhaust manifolds is	485,000
The auxiliary engine complete, including generator and sub-base	29,800
The weight of all the rest of the auxiliary equipment	33,500
The weight of the spare parts	23,000
Total weight of above, equivalent to about 220 lbs. per s.hp	571,300

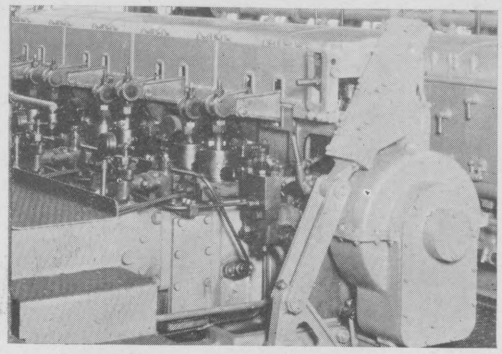
It is interesting to note that the complete reduction gear unit weighs 75,000 lbs. or about 29 lbs. per shaft horsepower, which leaves but 410,000 lbs. for the two engines complete, as noted above, which is slightly under 160 lbs. per shaft horsepower.

As regards cost, this can be segregated as follows:

Two main engines complete with reduction gear as above	$185,000
Auxiliary Diesel generator, pumps, air compressors and all other miscellaneous equipment as previously enumerated	35,095
Shipyard work, including new installation, overhauling painting and repairs	193,520
Total conversion cost	$413,615

Trial Results

The HERMAN FALK was delivered to the Sparrows Point Plant of the Bethlehem Steel Company on May 10th of this year with the stipulation that the conversion was to be carried out in 117 days. The work, however, was completed by the Bethlehem Steel Company about fifteen days ahead of schedule so that on August 19th the official trials were successfully run and the vessel accepted by the Owner. The



Showing valve tappets, rockers and camshaft housing

following day, Saturday, August 20th, the vessel sailed at 4:00 P. M. for Baytown, Texas, arriving there August 28th and after loading, sailed again for Baltimore, Maryland, on August 29th. The vessel has since been in regular operation.

The two main engines actually developed 2850 s.hp., driving the vessel at an average speed of 11.1 knots as the mean of four runs over the measured mile at loaded draft.

The determination of the net power delivered to the propeller shaft is made possible by the fact that both engines were tested in the shops with a water brake and their efficiency carefully ascertained. This was found to be 80.1% for the port engine and 78.6% for the starboard engine. Also, from the extensive shop tests carried out on the first Diesel unit, the transmission losses in the reduction gear were found to be slightly less than 1½% including all bearing and tooth friction.

On the trial runs at 90 propeller R.P.M. the port engine indicated 1844 H.P. and the starboard 1804 H.P., therefore, the port engine delivered 1478 B.H.P. and the starboard 1419 B.H.P. or a total 2897 B.H.P. Deducting approximately 47 B. H.P. for the transmission losses in the gear unit, the power actually delivered at the flange of the low speed gear was 2850 S.H. P. On this basis, the corresponding mean indicated and brake pressures were 116.2 pounds and 93 pounds for the port engine,

Herman Falk, President of The Falk Corporation, was aboard during the ship's trials

and 113.7 pounds and 89.4 pounds for the starboard engine respectively. The exhaust temperatures varied from 810 to 850 degs. F. During the trials, complete freedom of vibrations was observed throughout the vessel as well as both engines and gears.

Engineering Considerations

In the opinion of the Falk engineers standardization of product is today more imperative than ever before and that such standardization, however, is difficult of application to direct-connected high power, slow speed, marine Diesel-engines as, in order to adequately cover the range of powers required, builders are compelled to manufacture a variety of sizes and as, unfortunately, there are not today enough engines of any one size built at one time, quantity production methods can not be applied to such large engines.

Thus the HERMAN FALK engines are composed of cylinder units which have been used, for instance to build up a 300 b.hp. two-cylinder unit operating a rubber mill; also two 900 b.hp. six-cylinder unit operating the pump of suction dredges, while the six and eight types of these engines may be used for tug boat driven either direct connected or with gearing.

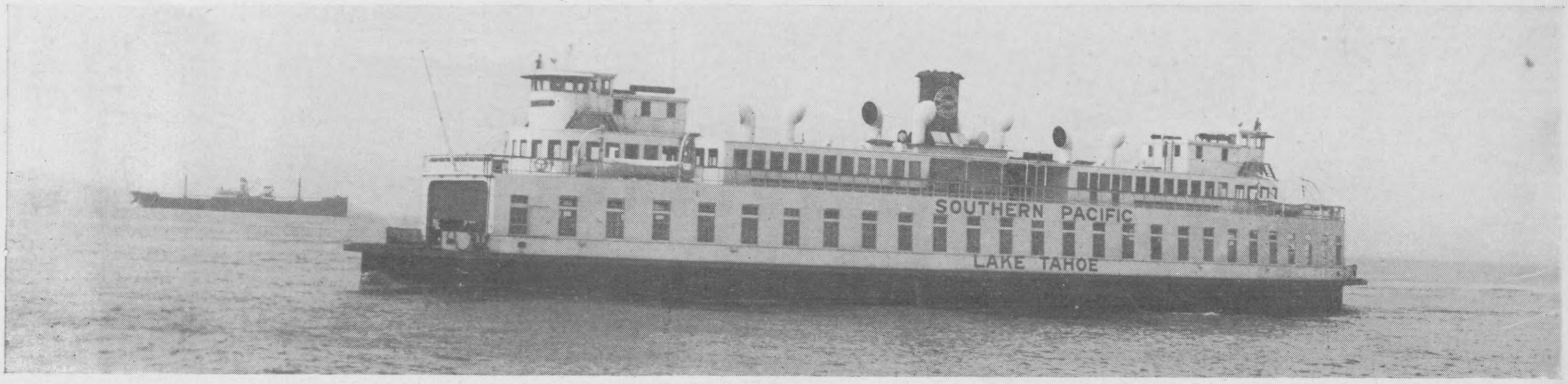
The gear drive also is obviously not confined to four-cycle engines as evidenced by the fact that two big passenger liners are being built at present in Germany for the Hamburg-America Line with powerful machinery consisting of twin six-cylinder, double-acting two-cycle engines geared to the propeller shafts.

Features which contribute in large measure to the simplicity and low cost of the engines used in the HERMAN FALK are the use of scavenging air at low pressure and uncooled pistons. The greatest benefit obtained by low pressure scavenging lies in the lowering of the cycle temperatures and consequent lower exhaust temperatures even for high mean effective pressures. This has been conclusively demonstrated by the tests undertaken by the A.E.G. of Berlin in 1921 which were extensively published in the German technical press. In this connection, it may be interesting to note that the original Falk engine was arranged as early as 1919 for connection to a scavenging blower.

With the Falk airless injection design combustion first begins in the chamber arranged in the cylinder heads, whence the gas flows on to the pistons at comparatively low velocity. The piston crown is made in the shape of a truncated cone which, when hot, follows its natural line of expansion by simply increasing its height with the result that any deformation does not stress the metal to an appreciable extent.

The HERMAN FALK reduction gear unit, which normally transmits 2600 S.HP. with a reduction of 275 to 90 R.P.M. cost only about $6.00 per H.P. transmitted. Obviously this cost would be but little affected had the propeller revolutions been decreased to 75 per minute, had it not been expedient to retain the old shafting.

Because of the many reasons outlined the operation of this first Falk marine installation will be watched with interest by the shipping world, and as it represents a most notable endeavor to produce a simple and comparatively inexpensive new type of propelling power.



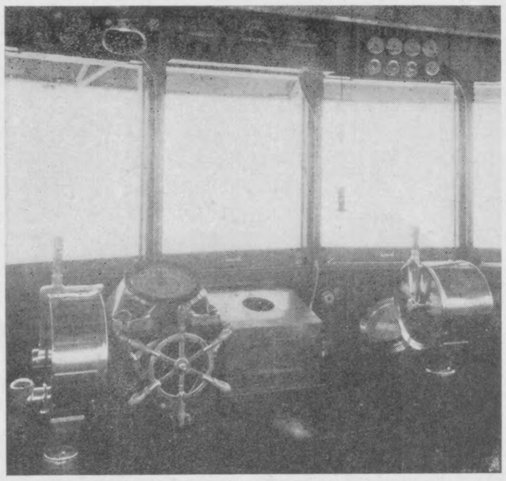
San Francisco's old steam ferries burn seven times as much fuel as this Diesel-electric vessel

Electrical Equipment of San Francisco's Ferries

Additional Particulars Concerning the Modern Propelling and Auxiliary Machinery of Two of This Pacific Port's Up-to-Date Harbor Service Craft

IN various issues of MOTORSHIP information has been given concerning the numerous Diesel-electric ferry-vessels now in operation in San Francisco harbor in the passenger and automobile services of the Southern Pacific Railroad and the Golden Gate Ferry Company, and we are now enabled to publish supplementary data on the electrical end of two of these fine ferries. Further interest is aroused at this time by the recent decision of the Golden Gate concern to build one more Diesel-electric ferry, because of the operating success and profitable operation of those already in service. It is to be hoped that San Francisco's modern fleet will form valuable food for thought for the municipal, railroad and private ferry operators on the Delaware and Hudson and East rivers some of whom appear to be either asleep at the switch, prejudiced against Diesel drive, or too strongly influenced by steam and coal interests with whom they have been in contact for so many years. It is taking the Pacific Coast to show them the way of progress.

The LAKE TAHOE, latest of the Southern Pacific Company's Diesel-electric ferries, and her sister ship, REDWOOD EMPIRE, which is operated by the Northwestern Pacific Railroad Company, have now been in service in San Francisco Bay for about two months. Both are proving to be admirable additions to San Francisco's fast growing harbor fleet. These two vessels were built locally by the Moore Dry Dock Company and are electrically equipped throughout by the Westinghouse Electric & Manufacturing Company. Of steel construction their principal characteristics it will be recalled are as follows:



Diesel-electric drive offers simple, efficient pilot house control

Length over all	256 ft.
Length between perpendiculars	234 ft.
Beam, molded	44 ft. 10 in.
Beam at main deck	63 ft. 6 in.
Depth of hull	19 ft. 9 in.
Power of four unit Diesel plant, normal	1800 b.hp.
Power of driving propulsion motor, normal	1250 s.hp.
Power of driving propulsion motor, maximum	1600 s.hp.

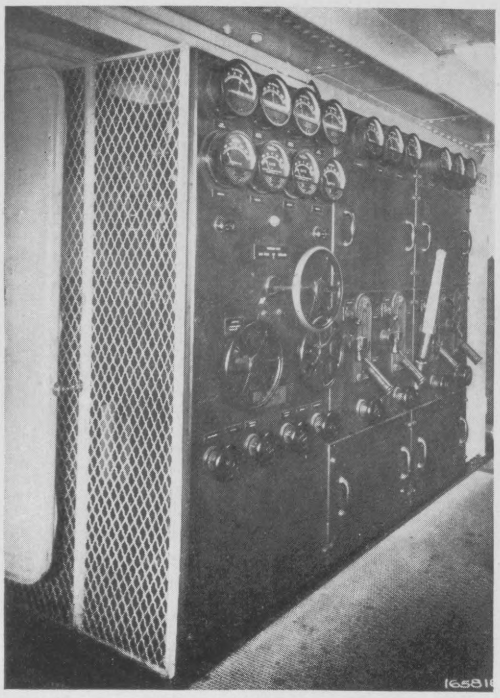
Prime movers of the main power-plant consist of four 6-cylinder, 4-cycle Nelseco Diesel engines of the airless injection type. They are of 450 b.hp. each and are directly connected to four 275 kw., 250-volt main generators and four 40 kw., 120-volt exciters. Of the double ended type, each vessel is equipped with two 1250 s.hp. 130 r.p.m. double-armature electric propelling motors with the control arranged for running the bow motor at slip speed, while the driving power is supplied by the after motor.

The four main generators are connected in series and supply power at 1000 volts to the two propelling motors which are connected in parallel. Variation in speed of the two motors with respect to one another is controlled by varying their respective field strengths, rheostats being provided for the motor fields so that practically any required variation of speed ratio may be had to give the most efficient operation for different operating speeds.

Westinghouse has used a parallel system of propelling motor connection on these boats, giving them excellent maneuvering ability, especially desirable for ferry service, the backing power being increased by applying a high torque to both bow and stern screws during a reversal of power.

No attempt was made in the design of the electric propelling machinery to provide

San Francisco's Diesel-electric ferries Redwood Empire and the Lake Tahoe are fine examples of modern harbor passenger-automobile boats



Dead front switchboards as on San Francisco ferries is a type advocated by MOTORSHIP

anything but the most rugged and reliable equipment, with ample overload capacity to utilize, if necessary, the maximum output of the prime movers.

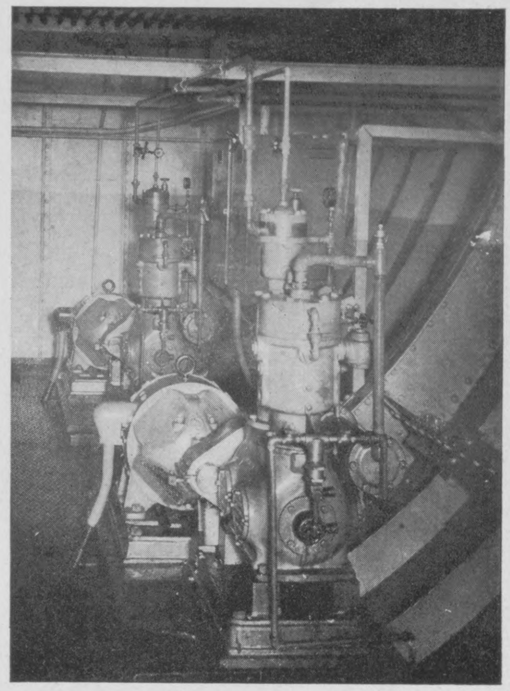
For control, the well known Westinghouse variable-voltage system of control is used, whereby all speeds and maneuvering are accomplished by varying the separately excited shunt fields of the main generators. Three control stations are provided, one in the engine room and one in each of the two pilot houses.

MOTORSHIP on several occasions has pointed out the importance of the "dead-front" type switchboards in the engine-rooms of motorvessels. It is interesting to note that on these modern ferries the dead-front type has been adopted, with 1-lever operated "back of board mounted" knife switches, the switches being arranged on a vertical sub-panel providing an installation on which the accumulation of dust and other foreign matter is reduced to a minimum.

Only in case it is desired to cut in or out one of the main generators, is the main switching equipment used, interlocks being provided so that it will be impossible to open the main propulsion current while the plant is in operation.

All the auxiliary equipment is electrically operated, including pumps, steering-gear, air-compressors, etc., even to the completely electrically equipped galley.

While under way, all auxiiary power is supplied from the direct-connected exciters. The auxiliary switchboard is of the line front type, the switching arrangement being such as to allow a distribution of the auxiliary power and excitation of the main units among the four direct-connected exciters, and at the same time does not allow the paralleling of the exciters. This system of connection removes the undesirable condition which would exist with the parallel connection where the prime movers are, as in this case of ferries, subject to sudden load variation.

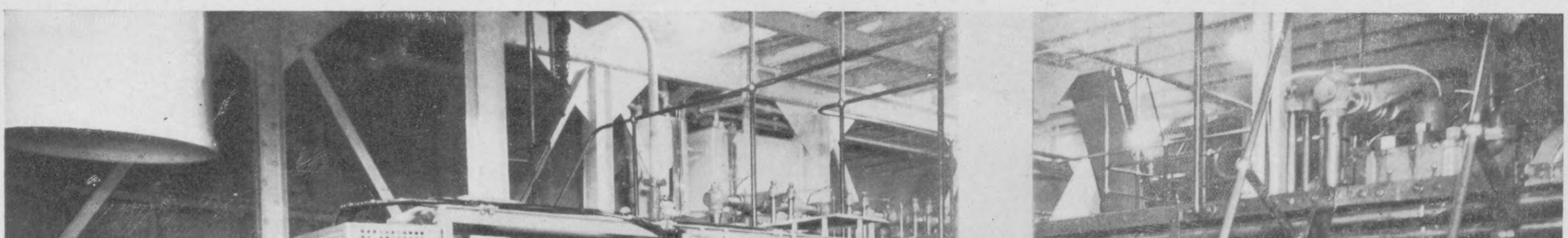


Electric-driven auxiliary compressors in engineroom of ferry Lake Tahoe

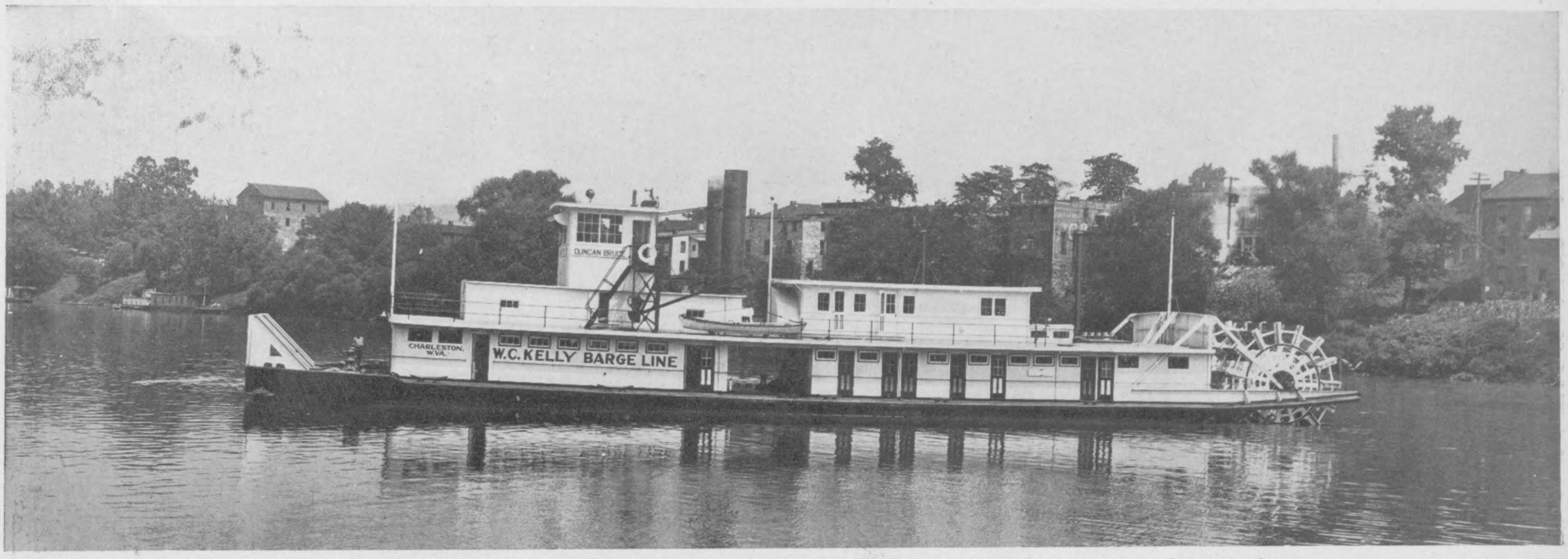
REDWOOD EMPIRE, the last of six similar ships, holds the trial speed record of 13.6 knots average over the measured mile.

The new boats have made a remarkable fuel saving over that of the old steam ferries, the electric drive ships operating on approximately one seventh the fuel of the steamers.

(*Continued on page* 776)



Showing Nelseco main Diesel engines and Westinghouse double-unit electric propelling motor in engine room of ferry Lake Tahoe. Machinery was running when photograph was taken

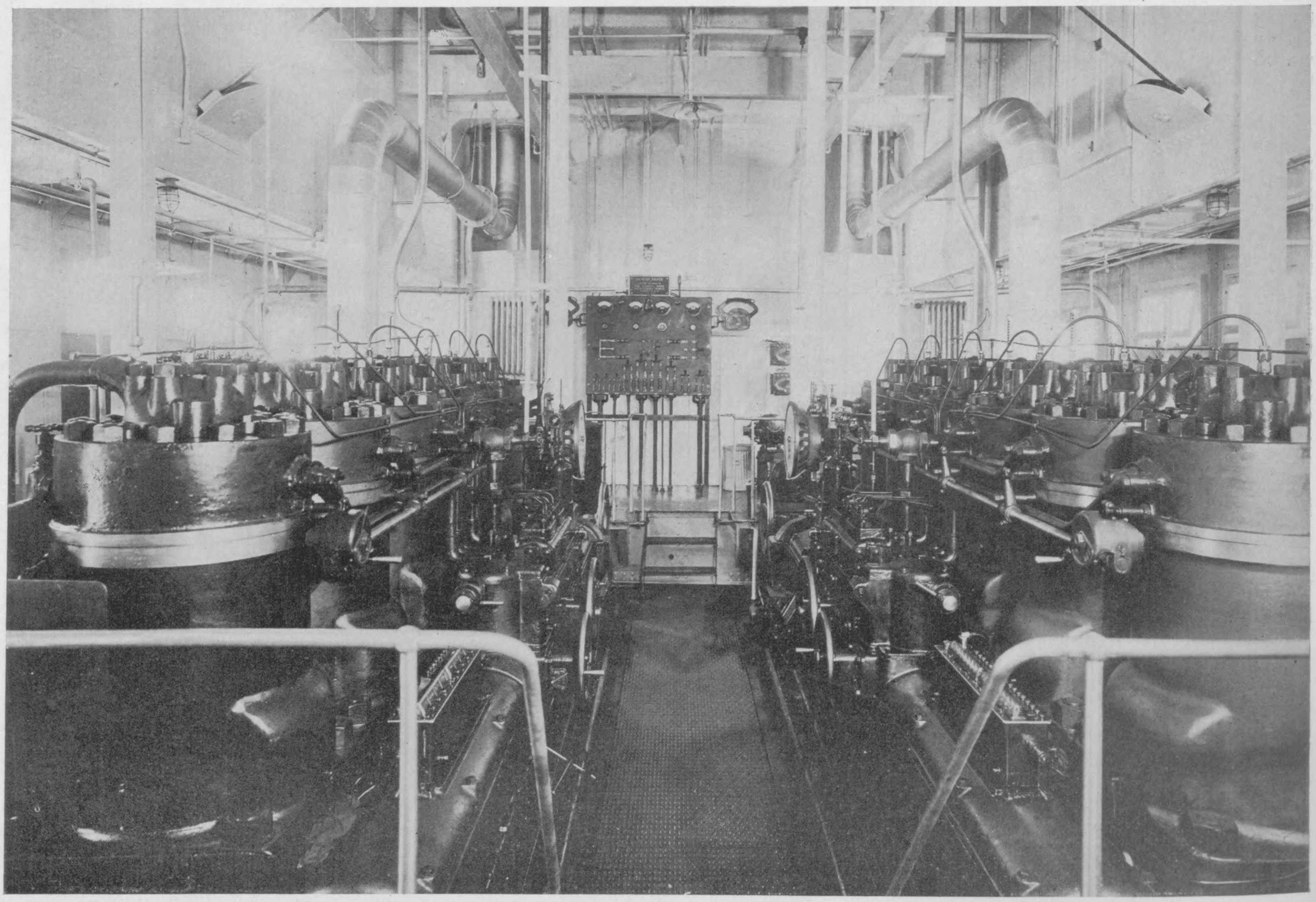


Diesel-driven towboat Duncan Bruce presents a radical departure from steam river craft

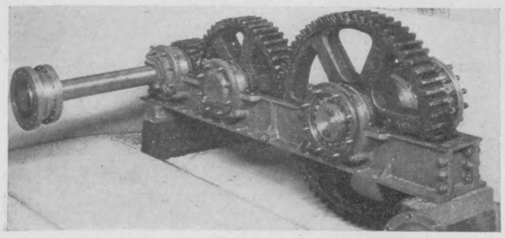
Four Powerful Tugs in Pittsburgh-New Orleans Service

River Towboat Duncan Bruce Completes Fleet of 720 s.hp. Diesel-Engined Barge Pushers. Reduction Gear Driven Stern Wheel Is Adopted

IT took a long time for river men of the Middle West and South to adopt the oil engine for stern-wheelers, but the success of the few pioneer boats rapidly converted many of the steamboat operators, and to such an extent that most of them are now even more convinced of the big economies to be effected than some of the old-time shipping men in the East. Diesel-driven craft—mostly tugs, ferries and dredges and but few passenger vessels—are being placed in service in rapid succession. This bears out the opinion recently given in a discussion with us by a big contractor on the Allegheny River who considers that there is a wonderful future for the internal-combustion engine on our rivers, and that rapid strides are being made.



It is only necessary to compare this clean, cool engine room of the Duncan Bruce with the boiler compartment of the average river steamer to understand one reason why Diesel power is popular with engineer-operators of our inland waterways



Reduction geared unit of Duncan Bruce. Cap removed to show roller bearings

When the description of the vessel forming the subject of this article is read, it will be realized how radical the change in river engineering ideas recently has been, as this very modern craft differs vastly from old-time coal-burners still in service.

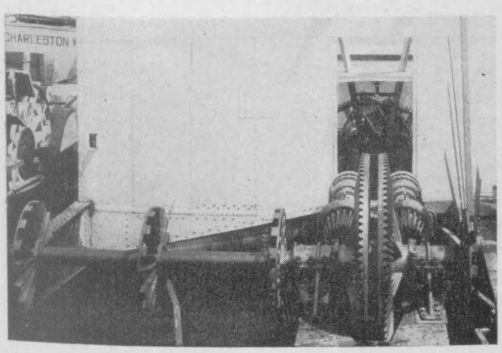
The W. C. Kelly Barge Line now owns a fleet comprising the largest and most powerful oil-engined towboats now in operation on our great inland waterways, having just taken delivery of the fourth sister motorvessel and the attendant tow of 22 steel barges. The fleet is working between Pittsburgh and New Orleans. The DUNCAN BRUCE, as the latest tug is named, was built by the Charles Ward Engineering Works from their own designs at their Charleston, W. Va., plant, and has the following dimensions:

Principal Dimensions.

Length overall	160 ft. 0 in.
Length b.p.	135 ft. 0 in.
Beam, molded	35 ft. 0 in.
Beam, overall	36 ft. 0 in.
Depth, molded	6 ft. 0 in.
Sheer, forward	1 ft. 6 in.
Sheer, aft	0 ft. 6 in.
Draft, aft	4 ft. 3 in.
Draft, forward, fuel tanks full	4 ft. 8 in.

One of the noteworthy features of this vessel is the reduction-gear system of power transmission, which we deal with a little later in this article. First, however, we will give her general characteristics.

The hull has a modified scow bow, long rake aft, and is of unusually heavy construction—much in excess of the American Bureau of Shipping requirements. Five longitudinal trusses and bulkheads provide excessive stiffness without the usual system of hog-chains so common on western river steamers. There are six water-tight compartments and the four fuel-oil tanks installed have a total capacity of 20,000 gallons, or fuel for 400 hours continuous operation at full power, including auxiliaries and galley range. The approximate consumption of the two main engines, without auxiliaries, is 288 lbs. per hour. River steamboat owners can make their own comparisons with the fuel consumption of a coal burning stern-wheel tug.



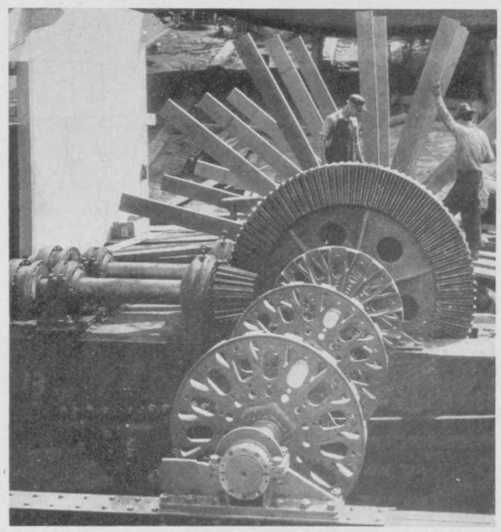
Showing bevel transmission gear to each wheel

Forward the deck space, 18 feet by 35 feet, is fitted with two motor-driven power capstans, four heavy towing knees, and the usual chocks, kevels and towing straps necessary for this type of towboat.

Steel construction has been used for the main deckhouse, 27 feet wide by 117 feet long. It is in two units separated by an open gangway 12 feet wide just aft of the engine-room. Forward of the machinery space are two rooms for general stores and a commodious locker for engineer's stores. The machinery space is 36 feet long and houses the entire power equipment.

Aft of the main gangway are full quarters for a double crew, bath-room, linen locker, mess-room, large galley, refrigerator and cold storage. The gear and tiller compartments are aft of the mess-room and galley.

A large deckhouse on the upper deck has staterooms for the captain and radio operator, with connecting bath, and also luxurious quarters for the owner. The pilothouse, of steel 12 feet by 18 feet, is located

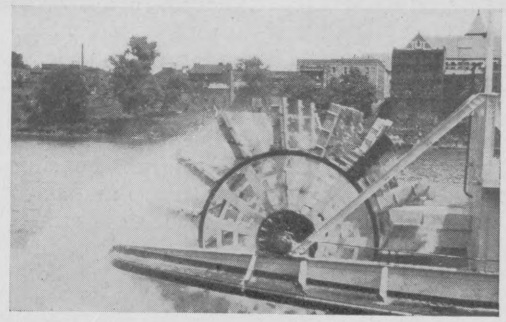


Another view of the bevel geared transmission

above the engine-room, and contains the regulation power and hand steering levers and pilot wheel, engine-room telegraphs, searchlight controls, switches, tell-tale boards, and last the beloved burnside stove—a necessary adjunct to all well regulated pilothouses on river boats, even though the ship is steamheated. Efficient, clean and economical electric heat has not yet been adopted on river craft, although this will eventually come. A steel bridge on each side provides access to the pilothouse and secure anchorage for boat cranes of 3,000 pounds capacity.

For propelling the DUNCAN BRUCE there are two Fairbanks-Morse six-cylinder airless injection two-cycle Diesel engines, each developing 360 s.hp. at 250 revolutions. They are fitted with air-oil operated clutches and coupled direct to reduction gears through line shafts 6 inches in diameter. The operation of the engines is so smooth and positive that the clutches are only used when warming up.

Engine-room floor and engine foundation, 3 feet 9 inches above the base line, provide deep girders and locate the line shafts and bearings below deck, leaving the entire deck space free for quarters and athwartship gangway. All auxiliaries, capstans and steering-gear are electrically driven. Current is supplied by two four-cylinder Hill Diesel engines, each direct connected to 18 kw. generators. A single-cylinder Diesel engine, belted to a 3-kilowatt generator, is used for stand-by service.

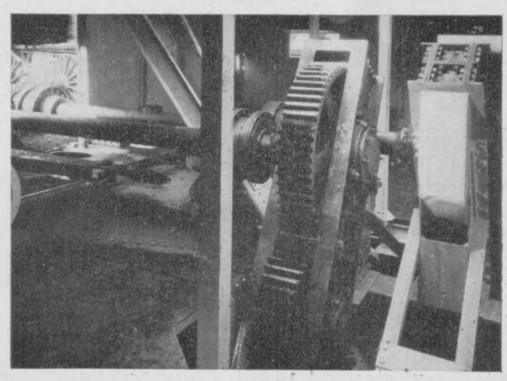


Wheel of Duncan Bruce turning 14 r.p.m. at bank

A feature which has great possibilities for more general adoption is that Exide storage batteries of sufficient capacity to operate the steering gear in emergency also to provide current for lighting, water service and refrigeration when the boat is in port, have been installed. Hot and cold water is supplied by duplicate Fairbanks-Morse automatic service pumps. A Hyde electric steering-gear is mounted on deck with limit switches located in the tiller room. Air and fresh water tanks of ample capacity are located below deck.

Successful performance of reduction gears for Diesel-driven stern-wheel boats is dependent on the permanent alignment of shafts and gearing, a condition extremely difficult to maintain with gearing mounted on the outboard end of the wheel shaft, as the wheel beams and fantails are subject to violent contact with lock walls, resulting in certain misalignment. The Ward reduction-gear, for which patents have been applied, is said to entirely eliminate this difficulty, as the gearing is mounted on a wide beam or gear housing in the center between the independent stern paddle-wheels. This beam is extremely rigid and may be considered as an extension of the hull; therefore the outside wheel beams and fantails are free to float on the wheel shaft in case of contact with lock walls or other objects, without the slightest movement of the gear housing.

Both wheel beams and gear housing are designed to carry full loads and power transmission strains without the use of kingposts and braces, the latter included in original design to be fitted after all wheel and machinery weights were in place and lined up. These braces carry no active load, but act as shock absorbers for bucket slap, which always sets up vibration in the



Reduction gears in position in ship

wheel beams and throughout the boat. The results obtained from this design are most gratifying. A coin will stand on the wheel beam when the boat is under full power.

The gearing is clearly shown by the accompanying photographs, and consists of two separate reductions—large bevel gears placed back to back with a thrust bearing between the hubs. As the bevel pinions are mounted outside the large gears the transverse thrust is therefore self-contained and friction eliminated at this point, as both wheels are revolving in the same direction.

The pinion shafts are mounted in four extra-large S.K.F. self-aligning roller bearings, and the end thrust is carried on special S.K.F. combination radial roller and ball thrust bearings. Floating shafts, with Poole flexible couplings, connect the forward end of the pinion shafts to the second reduction gears. These units are mounted on an A-frame foundation, thus providing suitable distance between the line shafts, as shown by the illustrations.

Self-aligning S.K.F. roller bearings are used for all gear-shaft bearings. The gears are inclosed in oil-tight cases and run in special gear lubricant. The wheel shafts revolve in plain bearings with removable bronze sleeves lubricated by mechanically operated forced-feed lubricators.

There are two stern wheels, each eighteen feet in diameter, with fifteen buckets. The wheels can be operated independently in either direction, producing unusual maneuvering ability when handling the boat in restricted quarters. With the right combination of wheels and rudders the boat can be moved sidewise without forward or astern motion. This peculiar condition is more or less freakish and of no value in handling heavy tows, as the flanking power of the four large balanced rudders, when both wheels are backing, is more than double the twisting action produced by operating the wheels in opposite directions. Under operating conditions the wheels should revolve as a unit in the same direction and at equal speeds. It will further be noted that the engineering department of the builders have succeeded in calculating and producing perfect trim and wheel immersion.

Within one hour after the engines were tuned up a series of continuous full power dock and dynamometer tests were run. During these tests there was not the slightest indication of trouble or stress in bearings, gearing or engines. The wheel design is from model experiments conducted at the Experimental Basin, Washington. The builders of the DUNCAN BRUCE conducted a series of self-propelled model tests in the Tank, and the result demonstrates for the fourth time the value of such data, particularly for Diesel-driven boats. This information, combined with additional tests now being made and trial records extending over a number of years, makes available a vast fund of data for the design and construction of the almost unique type of towboats required for our Western rivers.

Operating costs on the Western rivers—the builders advise us—are reduced to the minimum by the use of Diesel engines and properly designed boats, either stern wheel or screw tunnel. The saving in fuel and labor over that required for triple-expansion steam boats using oil for fuel, represents a substantial profit. They should be in a position to know as they have also built many steam driven river craft in the past as well as motorcraft.

The twin-screw Diesel towboat "Geo. T. Price," previously built by The Charles Ward Engineering Works, with 720 shaft horse-power, has a record of 10,000 revenue-producing ton-miles per barrel of fuel-oil consumed, compared with 3,200 ton-miles per barrel of oil burned on twin-screw triple-expansion condensing steamers of approximately the same shaft horsepower and in the same service. This information is taken from the operating costs of the Federal Barge Line during the period that the "Geo. T. Price" was chartered by them. To this must be added the wages and sustenance of at least two men not required on the Diesel-driven boat.

That river operators realize the economy of Diesel-engines is evidenced by the great interest displayed in each new boat and the increasing demands for boats of this class. There are now under consideration two or three Diesel river boats of over 1,000 horsepower each for early construction.

Golden Gate Orders Another Diesel-Electric Harbor Ferry

New San Francisco Bay Vessel to Have Ingersoll-Rand-Westinghouse Propelling Equipment

A further addition to the already large fleet of Diesel-electric ferries owned and operated by the Golden Gate Ferry Co. of San Francisco is to be made at once. Contract for three Diesel engines has been placed with the Ingersoll-Rand Co., while the order for the entire electric propulsion and auxiliary equipment was recently awarded to the Westinghouse Electric & Manufacturing Company. The new ferry will be the fourth vessel of this fleet equipped by Westinghouse, the others being the GOLDEN BEAR, GOLDEN POPPY and GOLDEN SHORE, now in operation in San Francisco Bay, together with several other Diesel-electric ferries that have another make of electrical machinery.

The principal dimensions of the vessel, which will be of the double-ended type and a sister ship of the other three, are as follows:

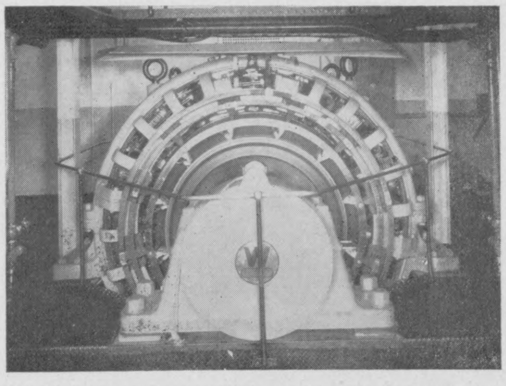
Length overall	240 ft.
Beam	44 ft.
Draft	13 ft.
Gross tonnage	780 tons

She will have a capacity of 350 passengers and 85 automobiles and her speed will be 13 knots. The propulsion equipment will consist of three generating units which supply power to two propulsion motors, one for each end of the vessel. Each generating unit will comprise a 460 b.hp. Ingersoll-Rand Diesel engine, direct connected to a Westinghouse 250 volt generator, devoloping 270 kw. at 265 r.p.m. and a 40 kw., 125 volt exciter. The propulsion motor will develop 950 shaft horsepower at 180 r.p.m. The Westinghouse variable voltage system of control will be used, whereby all speed control and maneuvering is accomplished by varying the separately excited shunt fields of the main generators.

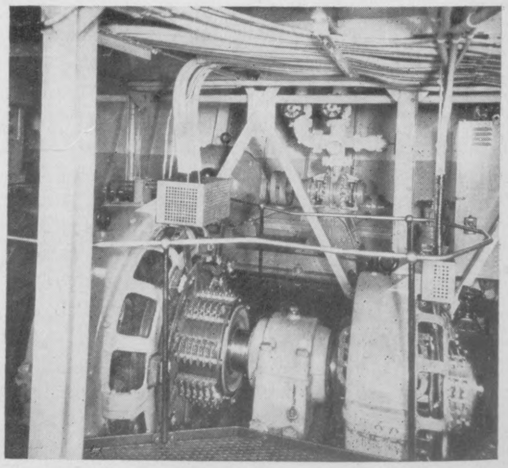
Electric Equipment of San Francisco Ferries

(Continued from page 773)

The Diesel-electric system provides drive for this type of vessel which, from a maintenance standpoint has never been equaled. They are operated continuously during the daytime and some of them are on twenty-four hours' service. The power plants are of such capacity as to allow schedule time to be made on three out of the four main generating sets, thus allowing the shutting down of one of the main Diesel engines for periodic overhaul without interfering with the continuous operation of the vessel.



Westinghouse propelling motor on Lake Tahoe. Note that the motor is running and free from vibration



Showing the generator and exciter at the end of one of the Diesel engines on the Lake Tahoe

There are now sixteen electrically driven ferries operating in San Francisco Bay and the increasing interest in this type of drive is indicated by the fact that eleven of the present fleet of sixteen ferries were put into operation since February last.

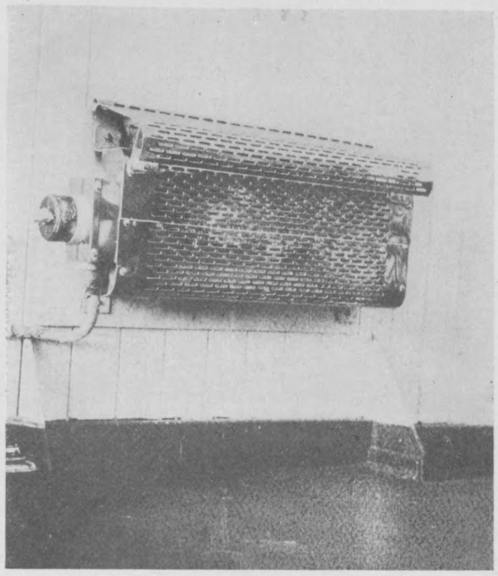
Electric Cooking and Heating on Motorships

Experiences with Ranges and Other Electrical Appliances on U. S. War Department Diesel-Electric Sea-Going Dredges—Fuel and Oil for Generating the Current Costs Under ½ Cent per Kw. Hour

By A. C. Tabbot*

THE electrical generating equipment of modern ships make possible the use of electricity for cooking, baking, water and space heating to a degree that was not thought practical a few years ago. The most valuable feature of this form of heat is its convenience. The temperature of electrically-heated apparatus may be maintained constant for any length of time. It is sanitary, safe, economical and improves working conditions. There are no ashes or fuel to handle and the heating units can be conveniently located. Where power is available at low rates—as with Diesel drive—it can also compare favorably in cost with other forms of heat.

The MARSHALL, KINGMAN, ROSSELL and MACKENZIE are all Diesel-driven, electrically operated dredges using this form of power for heating as well as other operations. Each galley is equipped with two 22 kw. Edison "hot point" electric ranges assembled as one unit. They are constructed for heavy duty and are very satisfactory. This gives a stove top with an area 6½ ft. by 4 ft. Each range has four hot plates of 4 kw. and two oven elements of 3 kw. The heating elements are provided with three heat snap-switches which control the temperature. The top heating elements are of cast-in construction, while the oven elements are inclosed in seamless metal tubing, giving ideal protection to the elements from mechanical injury.



One of the electric cabin heaters on Diesel dredge W. L. Marshall

Some of the everyday abuses to which the ranges are subjected to are—spilling of liquids and grease, dropping and sliding heavy utensils on top of the heating elements, dropping the oven door and even standing on it. During the past three years it has not been necessary to replace any of the top elements or hot plates. The oven elements last about two years under severe conditions before replacement.

Figures based on the absolute cost per kw. for operation of these ranges are difficult to obtain as the engines are run for auxiliary power and lights whether or not power is used for cooking. The consumption per day of these ranges over a period of thirteen months averaged 144 kw. hrs. cooking for a crew of 48 men. The cost per kw. hr. for fuel and lubricating oil averaged 0.46 cent or less than one half-cent per kw. hr. This gives an average fuel cost of 66¼ cents per day based on the cost of fuel at 5½ cents per gallon. This figure can be reduced with proper economy by the stewards' department.

For the information of cargo-ship owners it may be mentioned that separate power units are not required to take care of the cooking and heating load. The average load for cooking is from 23 to 25 kw. This together with the auxiliary power and light load of from 100 to 125 kw. gives a maximum load of 150 kw. A 150 kw. generator, 90 per cent efficient at full load, calls for an engine of 225 b.hp. Operating at full load the cost of fuel, per hour, averages 69 cents.

In the winter months, when the heating of quarters is necessary, the maximum load is greater than the output of the auxiliary generating unit. In order to take care of the additional load, power is used from one of the main generators which would otherwise be operated at somewhat below its rated capacity. With some installations it is possible to take power from each engine in operation in order to carry the cooking and heating load. When this is done, a smaller engine will carry the normal auxiliary load.

The subject of cooking by electricity seems to be well covered in the article on pages 170-171, in the 1927 MOTORSHIP MANUAL, but the paragraph on page 612 of the August issue of MOTORSHIP is somewhat misleading. The cost per kw.-hr. for the total power consumed can be lowered by operating the engine at maximum efficiency. This can be accomplished by the use of a storage battery where the peak load is higher and the normal load sufficiency under the rated capacity of the generator. This does not mean that a saving is actually accomplished. The average efficiency of a new storage battery is about 80 per cent. The gain in mechanical efficiency of the engine and the gain in efficiency of the generator, due to operation at full load, will hardly make up for the 20 per cent loss due to the use of the storage battery. A storage battery has many advantages, however, and its use is recommended. It improves working conditions by allowing

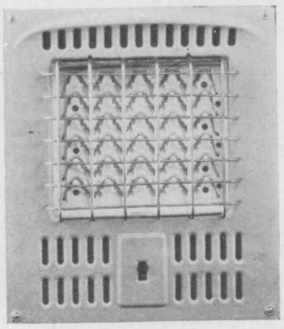
Edison electric range on W. L. Marshall. Note electric culinary appliances in foreground

*Chief electrician U. S. Engs. Dept. Hopper Dredge, W. L. Marshall.

Marine electric range developed by Westinghouse

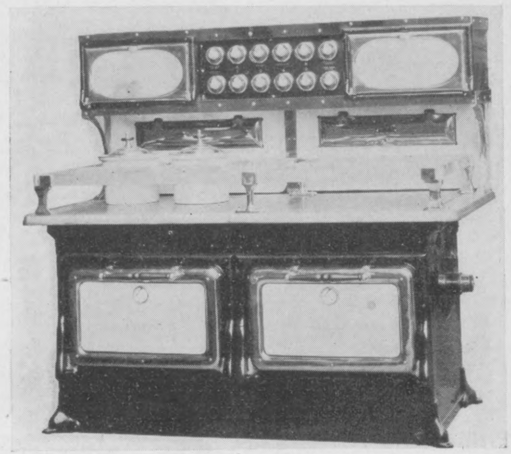
the engine-room to be locked when in port and is useful in carrying peak loads which would otherwise have to be carried by another oil-engine generating unit. Where the battery is floated on the line it will take care of the peak loads with an efficiency of as high as 90 per cent.

The Westinghouse hot-water equipment of the W. L. MARSHALL consist of three 25 kw. magnetic controllers. Each unit is controlled by a thermostat and motor operated switch. One unit controls the hot fresh-water aft, one the hot fresh-water forward and one the hot salt water which is used on the showers. The water is maintained at a constant temperature of 180 degrees F. Each bank of heaters consists of five (5) kw. heating units of the bayonet-immersion type. Normally only one unit is needed to keep the water at the required temperature and four are in reserve. A double pole, thirty ampere, snap-switch is installed on each heater circuit which allows as many units to be used as needed. All tanks and piping are heavily lagged to prevent loss of heat. The power consumption varies directly with the amount of water used and the temperature of the water.



Another type of Westinghouse cabin heater

In regards to space heating, the necessary heat required to obtain a certain result depends upon the character of the installation as well as the extreme variations due to local conditions. Any figures as to the power consumption of space heaters would, of necessity, be a very broad estimate. The total space heating load of the W. L. MARSHALL is 188 kw. but only in extremely cold weather is it found necessary to carry this load when operating. The Westinghouse heating equipment consists of twenty-eight 1 kw., twenty-three 2 kw., twenty-six $1\frac{1}{2}$ kw. and fifteen 5 kw. heaters, a total of 92 heaters aggregating 188 kw.

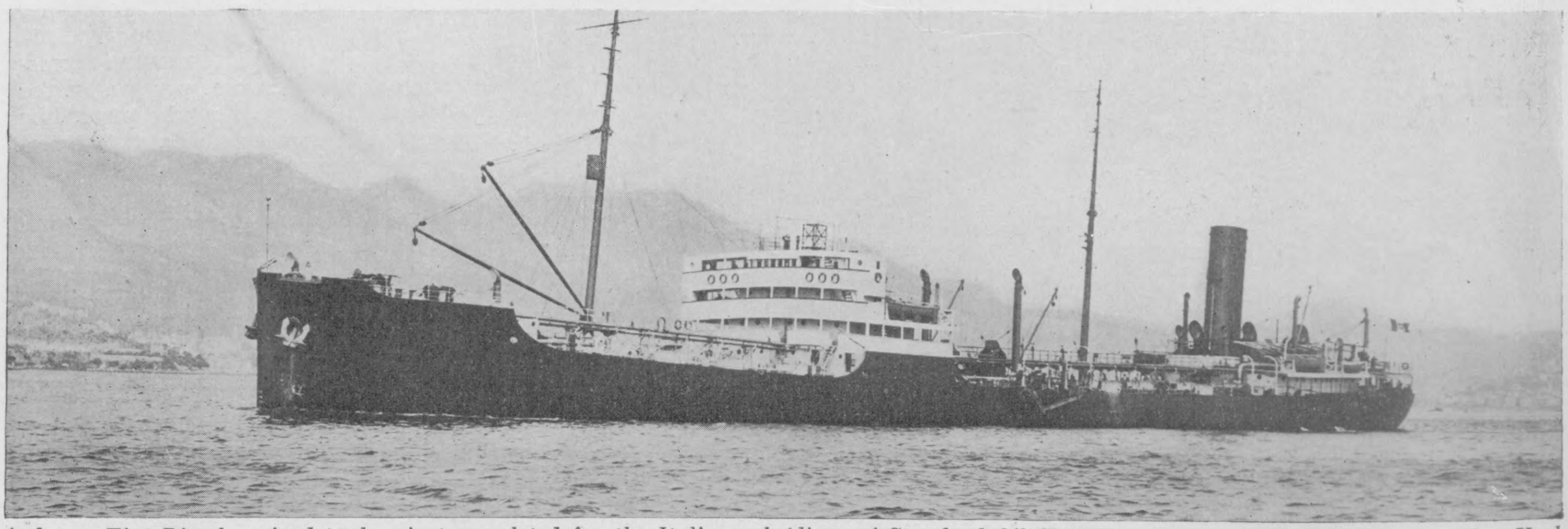


Standard marine electric range

The heaters are of marine type and of rugged construction with suitable lugs provided for bulkhead mounting. The top, bottom and front sides are covered with perforated brass guards. These protect the elements from mechanical injury and at the same time allow a free circulation of the heated air currents. A special rugged top is provided. The temperature is regulated by means of a three-heat switch which is located on or near the heater. Care has been taken in selecting dry locations, free from moisture due to spray or condensation. When these precautions have been taken, very little trouble is experienced with them. During the past three winters the repairs have been practically negligible. The heaters receive severe service and some abuse, especially those located in the engine-rooms, but require little or no attention.

Fiat Tanker For American Interests

AMONG motorships that recently arrived in New York was the tanker ARDOR, completed for the Societa Americana pel Petrolia—the Italian subsidiary of the Standard Oil Co. (New Jersey). She was built at the Ansaldo San Giorgio's Spezia yard and is propelled by two Fiat 4-cylinder, 2-cycle Diesel engines each of 1,500 s.hp. at 95 r.p.m. The contract speed was 11 knots loaded with a displacement of 17,500 tons, but the trial speed actually attained was 12.52 knots with the engines together developing 3,700 s.hp. at 104 r.p.m. On her maiden voyage from Spezia, Italy, to Baytown, Texas, the average speed in ballast was 11.73 knots, the engines developing 3,046 s.hp. at 94.5 r.p.m. collectively. On the return trip loaded the speed was 11.33 knots at 93.5 r.p.m. The layout of the engineroom is very compact, the main auxiliaries consisting of three 120 b.hp. at 350 r.p.m. Fiat Diesel engines connected to 80 kw. generators. Two of these sets also have auxiliary compressors connected by clutches. There are also two boilers in a separate compartment for the cargo pumps as well as the donkey boiler for the heating. Fuel and lubricating oil are cleaned by three De Laval purifiers. All new Fiat engined ships are of interest to American shipowners as the Nordberg Manufacturing Co., Milwaukee, Wis., are now constructing these engines.



Ardor, a Fiat Diesel-engined tanker just completed for the Italian subsidiary of Standard Oil Co. (New Jersey), prior to sailing for New York

The New Rochelle is a fine example of a modern economical Diesel towboat now rendering steam tugs obsolete

Diesel Tug New Rochelle Given Sea Tests

Fairbanks, Morse Oil Engine of 360 s.hp. Installed in New Towboat for the Red Star Towing & Transportation Co. of New York

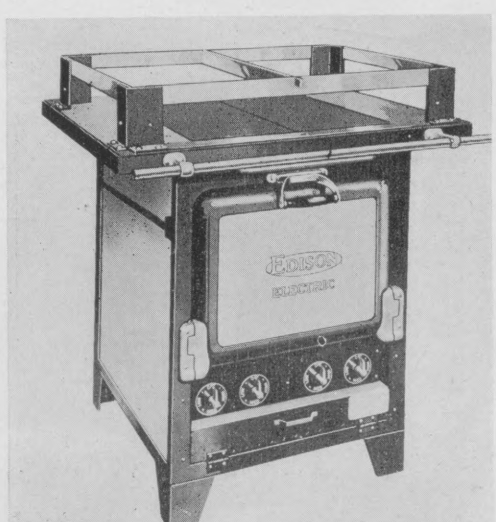
CONSIDERABLE interest was displayed in the trial run of the new motortug NEW ROCHELLE from Pier A, N. Y. to College Point in the East River and return. Representatives of many of the important local towing and transportation companies were aboard. This is not surprising when it is realized that during the past few years the number of Diesel-driven tugs placed in New York waters has increased with remarkable rapidity and the low operating costs compared with steam-driven tugs are outstanding.

The following marine transportation men were present: C. Nielson, Dauntless Towing Co.; A. Toppin, Gowanas Towing Company; Eugene Moran, Moran Towing & Transportation Company; A. H. Sanders, Red Star Towing & Transportation Company; A. J. McAllister, McAllister Brothers; C. J. Stumpp, Kelly & McAlinden, Company; W. E. Barber, Red Star Towing & Transportation Company; Charles L. Hyde, B. T. Nolan Company; W. S. Smith, Red Star Towing & Transportation Company; Gerald W. Ford, Ford-Payne & Sweisgudh Company; Edward L. Bartley, Bartley Scow Company; Lewis O'Donnell, O'Donnell Towing & Transportation Company; George Stewart and George McQuilain, Philadelphia & Reading Railroad; L. W. Smith, New York Towboat Exchange; H. A. Collier, New Haven Towing Line; F. T. Kellers, James McWilliams Blue Line; John A. Meseck, Meseck Towing Line; F. Mundt, C. Mundt & Sons; Frederick A. Russell, Newtown Creek Towing Company.

The NEW ROCHELLE has just been completed by A. C. Brown & Sons from designs by Merrit Demarest, and is of wood construction. Although her engine is of 360 s.hp., there is ample room to pass around the main engine and auxiliary machinery. The propelling unit is a 6-cylinder Fairbanks, Morse airless-injection Diesel engine of the direct reversible 2-cycle type, driving a 3-bladed 76 in. diameter by 46 in. pitch bronze propeller.

The quietness and simplicity of operation was particularly noteworthy during the trials and was commented upon by those aboard who went below to the engineroom.

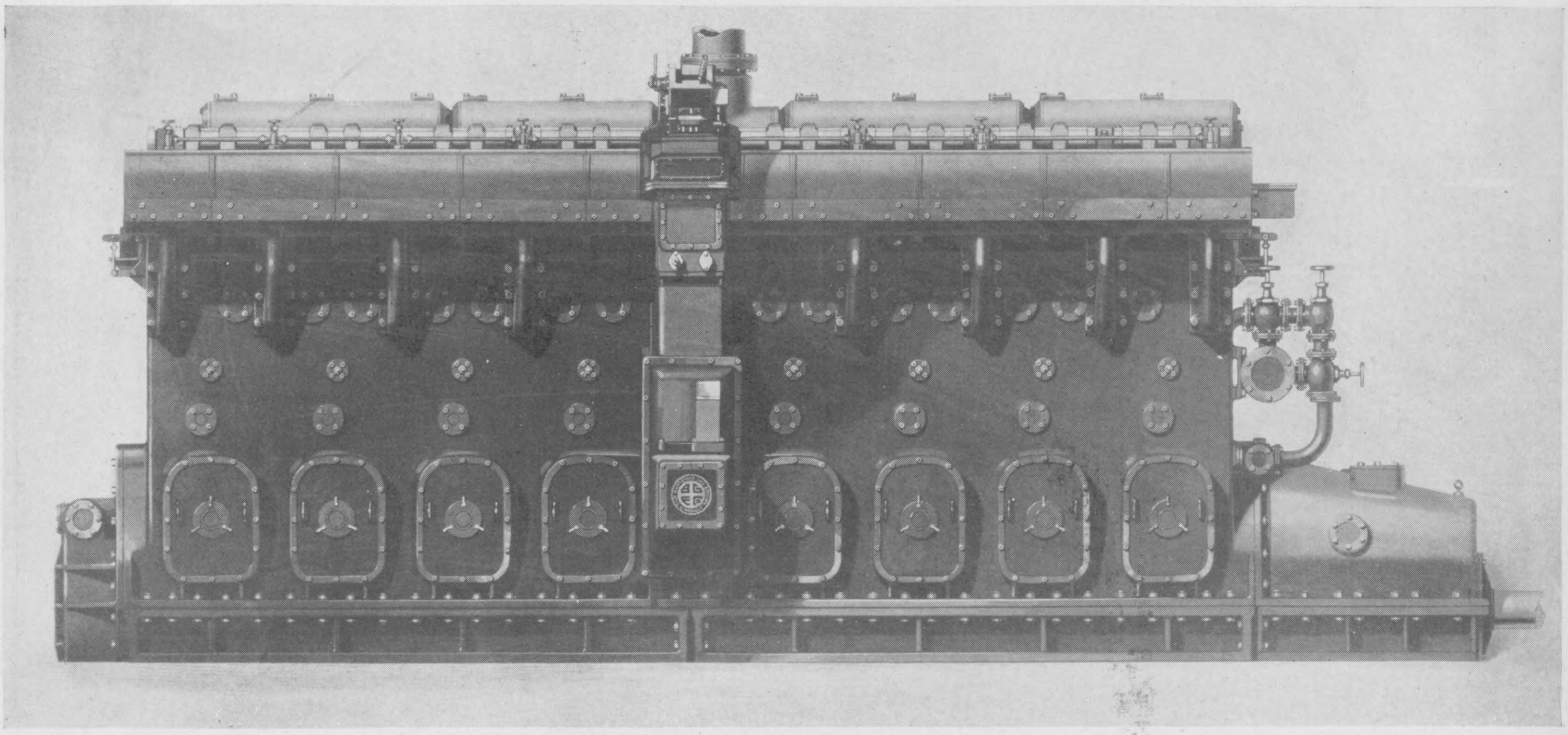
The tug has a displacement of 193 tons on a loaded draft of 9 ft. 3 in. Her length is 84 ft., breadth 21 ft. 6 in. and her molded depth 9 ft. 7½ in. For auxiliary purposes there is a 14 hp. Hill oil engine connected by a clutch to an Ingersoll-Rand air compressor giving 21 cu. ft. displacement at 350 lbs. Driven by chain off this engine is also an 8 kw. 125 volt d.c. electric generator. At the other end of the engine connected by a clutch is a Northern pump delivering 175 gal. per minute at 75 lbs. pressure. The steering gear is of the hydro-electric type built by the American Engineering Co. of Philadelphia and operated by a 3 hp. motor. The fuel capacity of the tug is 8238 gals. in addition to 258 gals. of lubricating oil. Her water tanks have a capacity of 516 gallons.



Small electric marine range for tugs and yachts, etc., where cooking has to be done for small crews only

Big Wooden Motorship Still Operating

The 1000 tons wooden auxiliary motorship RUTH built at the Columbia Engineering Works, Portland, Ore., in 1919 to foreign account has been sold and resold. Lately she was purchased by an Estonian shipowner and re-named IRIS. She is propelled by twin 200 b.hp. Avance oil engines. At one time she stranded and was condemned by the underwriters, but was repaired and made seaworthy.



This neat, compact Bessemer engine develops 1500 s.hp. at 375 r.p.m.

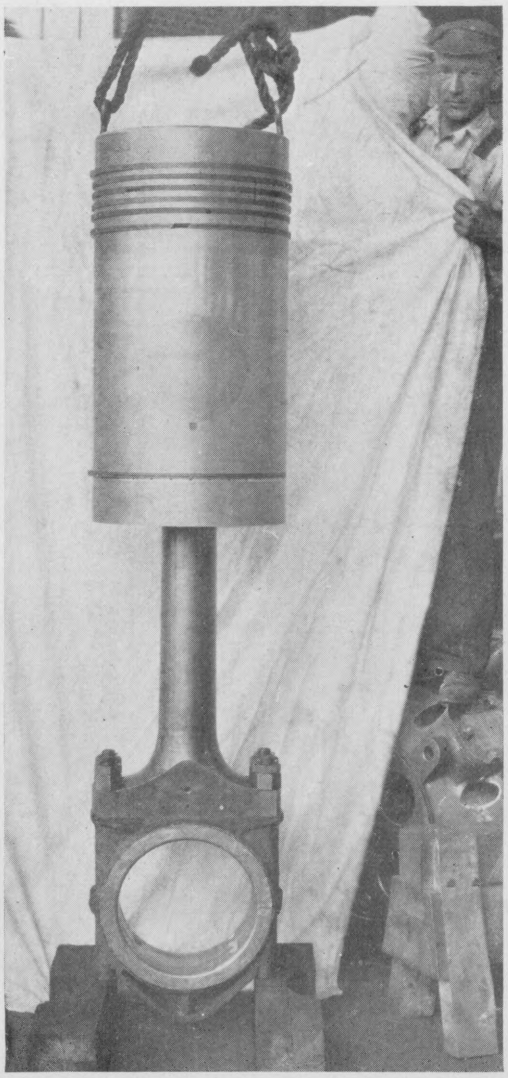
Big Bessemer Yacht Diesels Run Shop Tests

Twin 1500 s.hp. Marine Oil Engines for Cadwalader's Great Cruising Vessel Savarona II Make Excellent Performances on Test Bed

UNUSUAL freedom from vibration and a noteworthy simplicity of design characterize the new eight-cylinder 1500 s.hp. oil engines recently completed by the Bessemer Gas Engine Company for installation in the Diesel yacht —SAVARONA II, now under construction at Pusey and Jones shipyard, Wilmington, Del. This vessel is one of the two largest Diesel yachts in the world, the other being Vincent Astor's Diesel yacht building in Germany. Her machinery is of paramount importance, as it is no small task to construct powerful high-speed oil-engines to run with the smoothness and reliability so desirable with a luxurious pleasure vessel built for long distance cruising. It will be recalled that Richard Cadwalader's new craft will be almost 300 ft. long—294 ft. to be exact.

Of the four-cycle, trunk-piston, airless injection type and with a bore of 18 inches and a stroke of 22 inches, operating at a normal speed of 300 r.p.m. these engines are making a record on the test floor which is a significant commentary on the performance which may be expected of them when put in service in the SAVARONA II.

As shown in the accompanying illustration, the general lines of the units are strongly reminiscent of recent automotive practice and this impression is further carried out when a detailed study is made of the structural details. A feature which will appeal to the operating engineer is the centralization of control, which is made possible by a recently developed control system which makes its first appearance on this model of Bessemer engine. There is also a high degree of accessibility as any individual cylinder head can be removed with a minimum of labor and very little necessity for dismantling the cooling water connections or fuel operating gear.



18-*in. Bu-Nite nickel alloy piston of steel band construction*

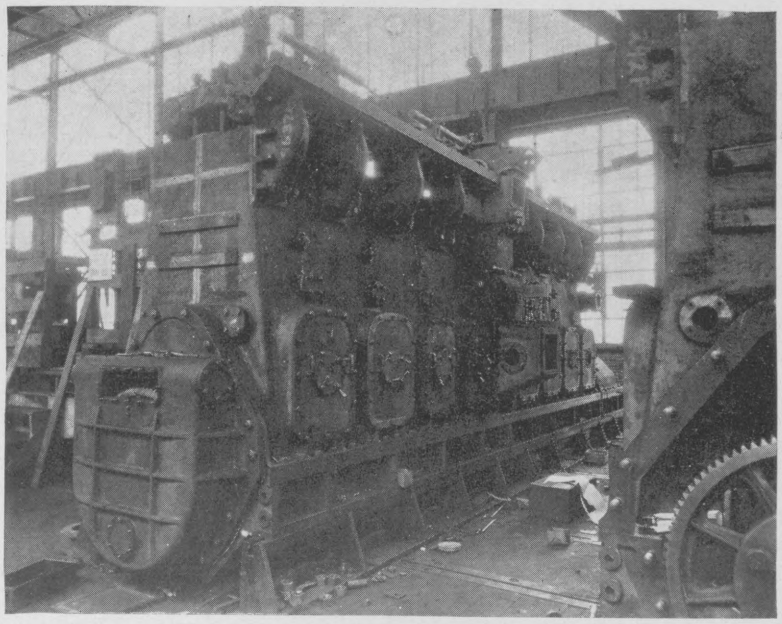
The complete enclosure of the valve mechanism is another innovation which improves the appearance of the unit and adds an additional factor of protection not ordinarily found on an engine of this size.

The base of the engine is built in two sections of four cylinders each as is the cylinder block. All of the base castings and the other structural castings on the engine are made either of steel or of semi-steel, a feature which adds greatly to the torsional rigidity of the engine and has also been a feature in reducing the over-all dimensions of the unit.

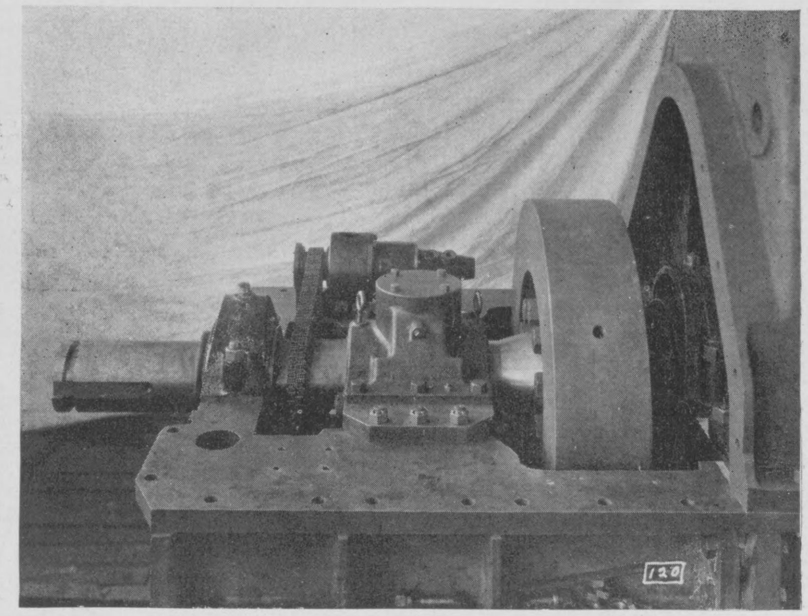
On the forward end of the base is mounted a barring-over-device consisting of a pinion on the crankshaft operated by a worm gear, which in turn can be moved from the outside by a large ratchet wrench. This hand-operated barring gear can also be fitted with a motor drive if desired. At the rear of the engine is mounted the flywheel and overspeed governor and a single collar thrust bearing.

The crankshaft is forged in two sections, each serving four cylinders. This shaft, which embodies the results of considerable investigation by H. F. Shepard, Diesel Engineer of the Bessemer Company is built to very generous dimensions,—the diameter of the main bearings and the crank bearings being 12¾".

In a series of exhaustive tests it has been found that there are no critical speeds up to 300 rpm. which is rather remarkable for an eight-cylinder engine of this size. It is therefore not surprising that at the normal speed of 300 rpm. the operation is as quiet and as relatively free from vibration as the most delicately balanced eight-



Bessemer engine nearing final stage of erection



Single collar thrust bearing and flywheel

cylinder automobile engine. This freedom from vibration of the engines on the test floor is particularly impressive when one notes that engine beds are merely supported on cast-iron laterals, rather than being bolted to their foundation in the usual way.

At the center of the crankshaft coupling in the middle of the engine is mounted a pinion which operates the chain drive to the overhead camshaft thru a 2-to-1 reduction gear. The location of this camshaft drive in the center of the engine has undoubtedly been a factor in achieving the steadiness of operation and compactness mentioned above and it also possesses the additional advantage of permitting the control station to be located at the middle of each unit.

The two center frame housings or water boxes each enclosing four cylinders follow the latest Diesel practice are of "H" type construction, exceptionally well braced. The cylinder liners are of semi-steel and are bored and ground to a smooth finish. A copper-asbestos gasket is fitted at the top of the liner, and at the bottom of the liner is a rubber gasket fitted with a removable gland for sealing the water circulation space in the center frame. Large cleanout plates are located at equal intervals along the center frame. Above the cleanout plates are located the lubricating oil lead connections through which lubricating oil is furnished to the cylinder walls by special Manzel timed lubricators.

Another noteworthy feature is that the 18″ pistons are made of Bu-nite nickel alloy with four steel bands cast internally to provide a guide for the expansion of the heated piston metal. The large size of these pistons is well illustrated by the accompanying photograph which shows their height in comparison with the man who is supporting the photographer's background.

The wrist-pin bearings are $8\frac{7}{8}''$ in diameter and the connecting-rods are of forged steel machined all over. Bearings are of cast-steel with removable shells closely babbitted by a centrifugal process.

Dual inlet and exhaust valve and cylinder head construction of the big Bessemer Diesel engine

Construction of the cylinder heads is clearly shown. It will be noted that an excellent distribution of material has been obtained by the use of dual valves greatly reducing the liability of thin sections in the cylinderhead castings. The heads are also baffled internally to assist the distribution of the cooling water and large clean-out plates are provided for access to the water space. Circulating water is taken from the jackets in the head to the cooling area surrounding the cylinder liners by passages located at four points equi-distant around the circumference of the head.

An overhead cam shaft is supported by large brackets bolted to the cylinder frame. Attached to each of these brackets is an additional cast upright which supports the rocker arm shaft. Each pair of exhaust valves is operated by a single rocker arm which transmits its impulse to them thru a hinged bridge. This method of transmitting the impulse from the rocker arm to each pair of valves constitutes a distinctly original solution of the dual valve problem.

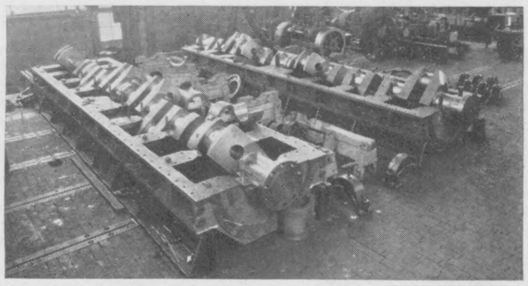
The fuel injection valve, located on the axis of each cylinder head, is operated by an inclined push rod which rides directly on the camshaft. An auxiliary shaft which is mounted parallel to the camshaft controls the movement of this push rod when the overspeed governor is brought into play.

An air starting pilot valve on each cylinder head is also operated by the camshaft. These pilot valves open the main air-starting valves to each cylinder at the proper time for starting and are automatically closed when the engines begin to operate on fuel. The relief valve are mounted as usual on the side of each cylinder head.

For reversing, the camshaft is mounted on eccentric bearings, the rotation of which permits the shaft to be disengaged from the rocker arms and moved laterally in order to bring the reversing cams into position.

Movement of the camshaft is carried out by an air ram mounted in the center of the engine in the same plane as the chain and pinions which operate the camshaft. The piston of the air ram is direct connected to a rack which rotates the camshaft and also brings into play a grooved cam supplying the impulse for bringing the reversing cams into position.

The air starting-valves, the air ram described above and the fuel pumps, are all



Bedplates and crankshafts of two 15 b.hp. Bessemer engines

controlled by a lever which works in a "U" shaped slot mounted at the top of the control housing. At the base of the "U" the lever is in the "stop" position. Moving it up in either limb of the "U" opens the air starting valve for operation ahead or astern (depending upon which slot the lever is placed in). As the lever is moved up the slot, the volume of starting air is gradually increased and the fuel pumps are then brought into play as the control lever progresses thru the full length of its swing.

During this operation an additional factor of safety is provided by having a lock on the control lever which must be depressed before it passes beyond the point where starting air is admitted.

Reversing the movement of the lever gradually cuts off the supply of fuel and the lever is then shifted to the opposite limb of the "U", where a similar air starting impulse is given in the reverse direction, this being followed with an increase in the fuel supply in exactly the same manner as described above.

The fuel pumps, mounted directly on the center frame are operated by a pinion engaging with the camshaft drive. All other auxiliary pumps and compressors are operated as independent units.

The two circulating pumps for the water cooler system are DeLaval units direct connected to a 7½ hp. Westinghouse motor. The two lubricating oil pumps are of the Northern 4-vane gear type of 120 gallons per minute capacity. They are likewise driven by 7½ hp. motors mounted on unit sub-bases.

Auxiliary compressors for furnishing the maneuvering and starting air are Ingersoll-Rand 2-stage 21 cu. ft. capacity units, also operated by motor drive. The auxiliary generating equipment for the yacht consists of two 6-cylinder Bessemer Diesels direct connected to 110 kw. Westinghouse generators, in addition to one 3-cylinder Bessemer Diesel rated at 60 hp. direct connected to a 40-kw. Westinghouse generator.

The marine practice followed in installing these engines also calls for water pumps and lubricating oil pumps which are of an individual capacity large enough to serve two engines in the event that one of the units breaks down.

Auxiliaries for Diesel Cutters

Five Diesel engines of 110 hp. each, together with the generating equipment, have been ordered by the U. S. Coast Guard from the Washington Iron Works of Seattle, for installation in the five new turbo-electric cutters now under construction which will be placed in service on the Pacific Coast. The engines will be of the 4-cycle airless-injection type.

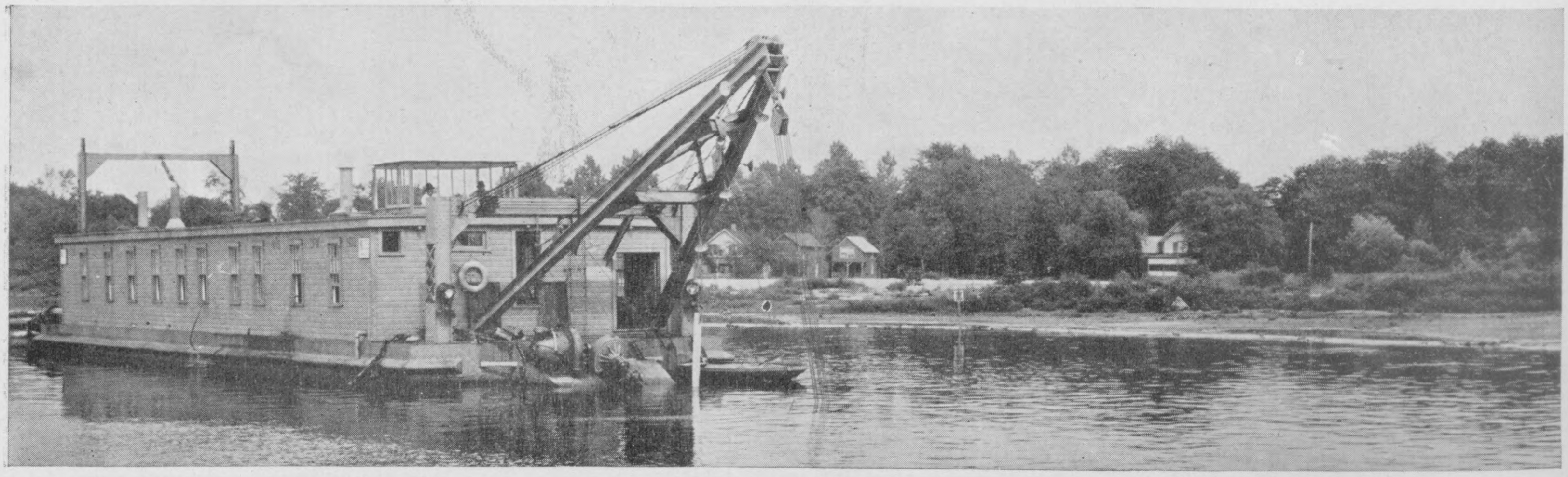
Not a Gyro Compass

In the caption under the illustration of the Holmes repeating magnetic compass on page 695 of our September issue, the compass was referred to as a Gyro compass, which of course, is incorrect. A magnetic compass depends upon the earth's terrestrial magnetism, which a Gyro compass does not.

Side-Ladder Dredge with Oil Engine

Now in operation on the Elk River is a new 105 ft. steel side-ladder dredge, which is the first of her type to be operated by an oil engine. The MOUNTAINEER, as she has been named, was built by the Midland Barge Co. for the West Virginia Sand & Gravel Co., Charleston, W. Va. In this craft the digging buckets are operated by belt drive from an 80 hp. Fairbanks Morse Diesel engine. There is an extension shaft driving a jackshaft, which in turn drives a 40 kw. d.c. generator and a 4 in. centrifugal pump. The generator supplies current for the two hoists, one for handling the digging ladder and the other for operating the spud lines and maneuvering lines. The operating crew of the boat consists of one man and a helper, the latter also acting as deckhand.

Machinery arrangements of the MOUNTAINEER were planned by the Research Division of Fairbanks, Morse & Co.



De La Vergne Diesel-driven 15-in. hydraulic dredge placed in service last year by the New York Commissioner of Canal and Waterways. She is of similar design to the new New York State canal dredge to have Bessemer Diesel engines. See page 690 Sept. issue

Ventilating the Motoship's Engine Room

Proper Study of Individual Ship and Engine Types Necessary for Good Ventilation and Better Operating Conditions

By Chief Engineer

MACHINERY spaces of motorships have a peculiar odor not at all like the sweet damp smell which greets the nostrils upon entering the engine-room of a steamship. The latter must be credited with such advantages as are justly due her and on this account it is just possible that under certain conditions her power-plant compartment is a more healthy working place, in spite of the greater heat, than that of the motorship.

It may be argued that this comes within the province of medicine rather than that of marine engineering, yet it is questionable whether many medical men know a great deal about why odors are encountered in engine-rooms even though a certain amount of discussion has recently been raised on that matter. Sea-going engineers generally consider the engine spaces in larger and more modern motorships to be freer of gases than those in the older and smaller ones.

It may be that in their zeal to develop perfect machinery layouts on motorships designers have failed, in some cases, to give sufficient attention to engineroom ventilation, and have merely copied the methods employed on steamships without considering whether or not such methods were equally applicable to motorships.

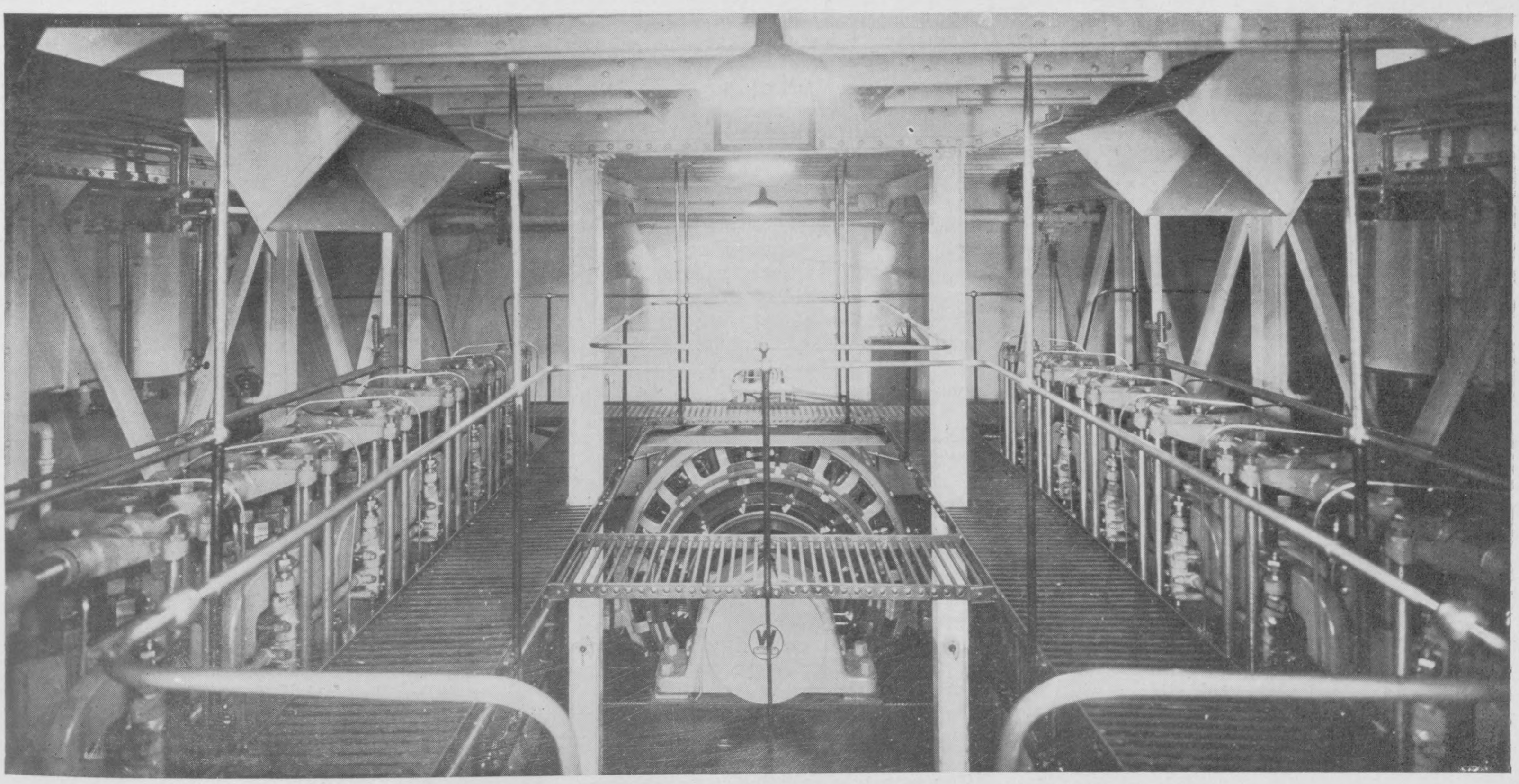
The fact that oil engines are constantly removing the air from the engineroom and expelling it in a decomposed state through the exhaust pipe, thus creating a natural ventilating system, may have been misleading. It is certainly true that the combined effort of the engines and the compressors is commonly great enough to change the air in an average motorship engineroom every 8 to 10 minutes. Unfortunately the rate of escape of foul gas, no matter how bad the gas be, is not nearly proportionate.

When bad gases are troublesome the fault seems often to lie in the route which the air takes in its passage from the atmosphere to the engine breathers. In many instances clean air is released in the engineroom at points which are quite conveniently reached from the open air by ventilator shafts. By this statement it is not inferred that ventilators merely pierce decks without being carried to the lower flats or set in the far corners. A complete disregard for the possible location of bad gas pockets, however, is quite common and certain parts of the engineroom are always more comfortable than others. That is possibly natural because places which are best ventilated are the places where the engineer should and does spend the most of his time. Thus conditions are more often than not far from being the worst possible, but in a perfect machinery space the gas pockets should be eliminated.

If this is to be a problem for ventilating engineers to solve they will have to take into account the fact that escaping gases should be directed back into the engine breathers or out to the atmosphere if the solution is to be found in the most economical way. It is not merely a question of driving more fresh air into the engineroom; furthermore it is doubtful whether this could be done successfully, because it would merely mean that more air would become contaminated by bad gases and while the percentage of the latter would be proportionately less they would not be eliminated. Further space may be limited and much extra equipment would have to be carried. No shipowner wishes to have a lot of cumbersome air ducts installed in the engineroom and certainly no engineer wishes to have more machinery to care for.

We call to mind one installation which had a very bad reputation for gases owing to expansion joints on the exhaust pipe. The deck over the engines was low and had a small skylight. The workshop for the routine overhaul of valves and other parts was under this deck and the engines were burning a fuel with a high sulphur content. The engineers constantly complained of sulphur fumes the presence of which indicated the existence of gas pockets. Since carbon dioxide and carbon monoxide are practically odorless and neither had ever been present in sufficient quantity to be felt it remained for the rancid smell of sulphur to reveal the presence of such gas mixtures.

The problem was partly solved by piping the engine breathers to the gas pockets and depending upon these to set up a natural flow of fresh air in that direction. Of course, there could be no excuse for the bad expansion joints, and in that respect



System of ventilation in engine room of the Diesel-electric ferry Lake Tahoe

the engine builders were solely at fault for repeated efforts on the part of the engineers to keep them tight had failed. Possibly the engine builders did not understand how important it was to stop these leaks, nor did they know how bad they were.

On another motorship the lubricating oil fumes gave trouble. The engines were high speed 2-cycle type with separate scavenge pumps, and had "breathers" from the crankcase to the engineroom. They were naturally hot machines, for the pistons were cooled with oil which fell back into the crankpits and was pumped from there to coolers. The entire compartment was exceptionally warm as compared to the average motorship engineroom.

The scavenge pumps took their air direct from the engine-room. The engine builders thought the air was too hot when it reached the engine and to reduce its temperature the breathers were piped to the open air. This was a clear case of thoughtlessness. If the scavenge air was too hot it should have been put through a cooler, but on no account should the natural method of ventilation in the engine-room have been disturbed.

We have noticed two very good systems of eliminating bad fumes on small motorvessels. One was a tug and one was a Sound passenger-boat. The crankcases of the trunk-piston type engines, fitted on each ship, were tight. On both sets of engines a hole was cut in each end of the crankcase. On the tug the engine breathers were piped to one of the holes and air was drawn the length of the crankcase. On the other boat a small cowl ventilator on deck was piped to the front end of the crankcase, and an air duct was led from the after end to the stack thus setting up a similar but less rapid circulation of air to that on the tug. In both instances the circulation of air through the crankcases had a remarkable cooling effect upon the working parts enclosed.

Oil-engine manufacturers raised an objection to this method of deodorizing the engine-room and contended that the removal of fumes increased the lubricating oil consumption. They declared that the oil vapor if left in the crankcase would condense and become oil once more. This is possibly correct but it is equally true that the vapors if allowed to escape through the crankcase breathers and inconvenience the engineers would also constitute a form of oil loss.

Diesel engines have a limited number of causes by which foul gases can escape. One is leaking exhaust pipes, another is gas blowing past the pistons, a third is the pungent odor of lubricating oil on hot surfaces, a fourth is the escape of gases from the valve stems and the last is caused by fuel oil spilled or leaking on the cylinder heads and possibly finding its way to the exhaust pipe elbows. With regard to the last two items, one is negligible and the other is up to the operating engineer.

Leaking exhaust pipes are the result of carelessness on the part of the designer, the man responsible for the installation or the operating engineer. Theoretically gases should not blow past the pistons; actually they do. Lubricating oil fumes do not appear to be very harmful but their elimination is desirable nevertheless. The biggest difficulty seems to be in connection with these two items.

It is readily apparent that this does not apply to all engines. The double-acting engine, for example, eliminates troubles with odors resulting from leaking rings. The small 2-cycle engine delivers all gases into the working cylinder. The large single-acting crosshead type of engine seldom has great heat in the crankcase and no fumes from there. Gases do escape by pistons however, and the cylinder walls being comparatively hot also throw off an odor.

The trunk-piston type with a partly open crankcase presents another problem. Air is a cooling agent for these pistons, in most instances, and if it carries oil vapors they will become a troublesome gas. If the pistons are oil cooled that will also throw off a gas.

It seems that we have the problem largely confined to the crankcases of the 4-cycle trunk-piston type, the 2-cycle type with separate scavenge pumps and the crosshead type with open lower ends of the cylinders.

It is only necessary to close these spaces with comparatively tight doors and lead air ducts to the enclosure. Suction blowers can be placed in the air ducts and the gases blown to the atmosphere outside of the engine-room, up the stack for example. This would not prevent having doors that could be opened to inspect the various working parts within while the engine is running. There would be only an inrush of fresh air at such openings while the doors were removed.

When a ship is on the sunny side of the pier at places such as Singapore, Cartagena Colombia or Tampico, forced ventilation is a blessing to the engineers, and is equally welcome in waters such as the Caribbean Sea and Indian Ocean when a following breeze alternates with no wind at all. At such times foul fumes seem to come creeping out of the bilges and off the hot floor plates, almost out of the ship's sides in fact.

It would appear that just so long as men go down to the sea in ships they will have to face certain hardships which are directly chargeable to the elements. To eliminate disagreeable conditions such as we have dealt with specifically in this article appears to be not only desirable but entirely possible. That certain men are already thinking seriously along such lines is evidenced by the fact that a vapor extractor has been produced and is being marketed. For those who think along different lines mechanical devices are already available. Blowers are being applied to almost every such need and it only remains for someone to install them in such a way as to not scatter the gases, but to pick them up at their source and deliver them to the open air where they can do no harm and cause no inconvenience. Experienced designers are attending to these matters.

Mess Room Maxims and Morals

The man who kicks most about having too much to do is commonly the one who has so little to do that it will not even keep his mind off his troubles.

Everyone agrees with the chronic kicker but no one likes him, whereas no one agrees with the optimist but everyone likes him.

The crew that is always kicking about what a "rotten" First Assistant they have is always the same crew that goes ashore and brags about what a hell-uv-a-fine engine room they work in.

Since all engineers have read books half filled with thermodynamics isn't it surprising that most of them know more about *how* the engine works than *why?* Or is it?

We can generally judge the brand of discipline maintained by the simple process of observing how, when, where and who gets a bawling out. It is not always the man who can curse the loudest that gets the best results. Speak easy, but firmly!

Most of us age about a year whenever we hear an explosion diaphragm let go in the horsepower air line. To prolong our lives and retain our youth let us change the diaphragms about once a year.

The man that is always in a furious rush to get finished with his work is generally like the guy with buck-fever. He goes off half-cocked. Moral, be thorough—not through!

Try the low suctions in the fuel tanks occasionally and then you will know whether there is any water in the fuel.

A dirty rag in the trash can is worth a ton of waste in the bilge.

When you are steaming out the ammonia condenser be dam' sure not to release any ammonia in the system.

To take indicator diagrams will tell whether or not the engine is working correctly but will not make it work right.

The man who will insist upon being ashore when the ship sails may as well resign himself to losing his job.

The time to get caught up with the work is before the work gets ahead of you.

One reason a packing gland leaks is because there is no packing under it.

Ever have asthma? That's the way an engine feels with the air inlet breathers clogged up.

It is better to boost the pressures and make the safety valves lift while you are watching than to let them set and stick and then have the pressure go up while you are not watching. If you don't you may go up too!

If you are not always telling about how much you know there will be fewer people thinking you a liar or a hot-air merchant.

Oil engines, like women, respond to good treatment, but there are some just so dog-goned contrary that the better you treat them the worse they act.

If you get yourself in a jam you may lie out of it but if you get the engine in a jam you'll have a sweet time lying out of that.

We are all more interested in our rate of pay than we are in the job but the rate of pay will remain stationary if we don't take an interest in the job.

Stop oil leaks and the engines won't need diapers.

Grinding compound left in the fuel check blocks will keep the fires in the shipyard burning.

A little profanity will sometimes relieve back pressure but don't try to out-cuss the Chief; he probably learned under experts.

Life is sweet; don't slam the covers of the fuel oil cofferdams.

Don't vent your wrath on the controls—there's no sensation in matter.

It has been said that "if a little is good a whole lot is better" but don't try this idea on the air compressor lubricator.

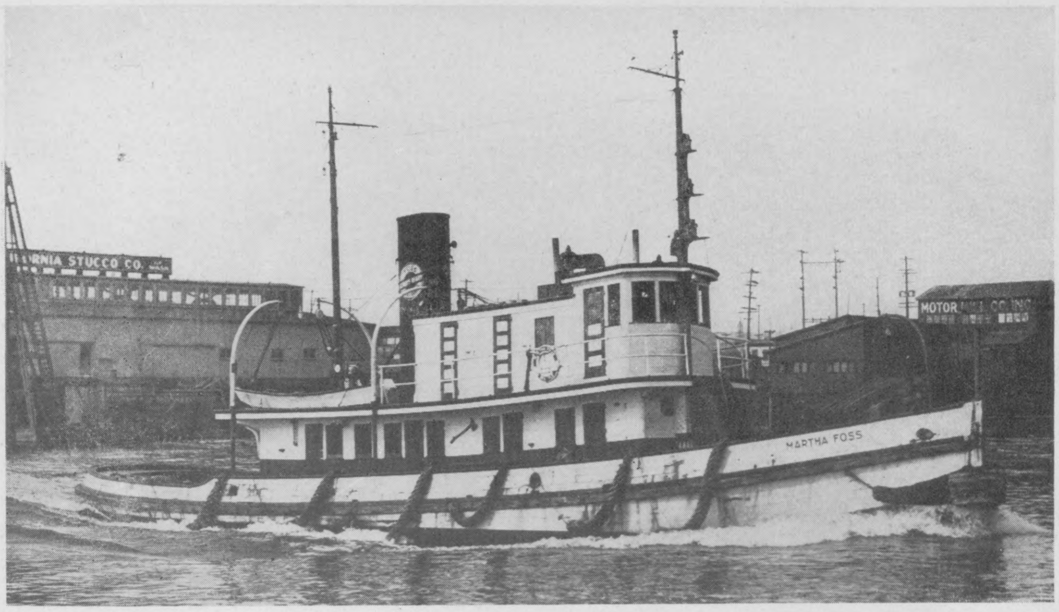
Grease wiped off of the top ladder step in time, saves nine.

Do your knocking with a hammer; you'll accomplish more.

Pacific Coast Steam Towboat Converted

The 92 Ft. Tug Martha Foss Is One of a Well Equipped Fleet of 16 Big Diesel Towboats in Puget Sound—Seven More to Be Added

ONE of the most notable conversions from steam to Diesel power in tug boats on the Pacific Coast was made recently in the case of the MARTHA FOSS, a 92-footer owned by the Foss Company of Seattle and Tacoma. This company is claimed to be the largest operator of Diesel tugs in the United States and has pioneered extensive application of Diesel power to Northwest towboat service. The Foss fleet now consists of 16 Diesel vessels out of a total of 32 boats; and the company



Tug Martha Foss fitted with 240 hp. Diesel now operating in Puget Sound

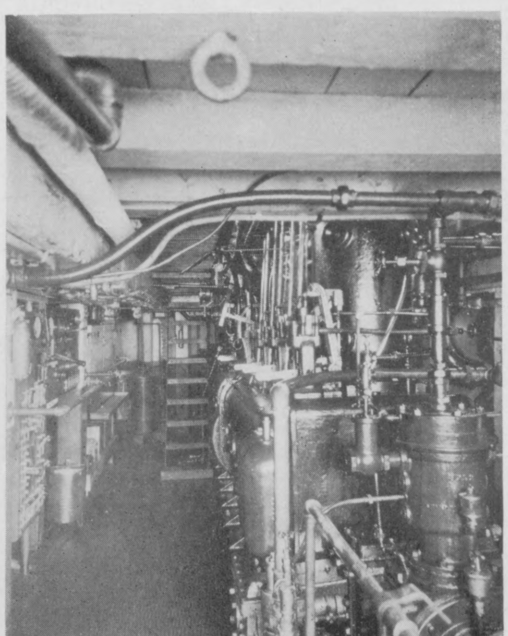
has just purchased seven 500 hp. Busch-Sulzer submarine Diesel engines for new boats and for converting a number of their present gas-powered vessels.

The MARTHA FOSS was formerly the steam tug DOLPHIN owned by the Killisnoo Packing Company of Southeastern Alaska. She is 92 ft. long by 22 ft. beam by 12 ft. draft and heavily constructed with 12-in. frames on 6-in. centers. The hull is stiffened by fore and aft timbers 18 in. by 24 in. through bolted to every frame. There is a 4-in. by 12-in. hardwood strip along the bottom on each side of the keel. Back of the pilot house is a texas containing the captain's cabin and staterooms for the mate and engineer.

The conversion of the MARTHA followed the earlier Dieselization of the FOSS 21 in which was installed a 240 hp. Ingersoll-Rand Diesel engine of the same type as was put into the MARTHA. These two engines have an interesting history. They were originally shipped to China for the French government during the War where it was planned to install them in French vessels. The close of the War caused the cancellation of these plans and the engines, in their orginal cases, were left in China. During the several years before they were purchased by the Foss Company, they were entirely neglected, passing through several insurrections and, according to Arthur Foss, used as barricades by the contending factions.

The engines were still in the original cases when shipped to Seattle by the Foss Company, but so thorough a job had been done in their packing that not the slightest damage was found. Guided only by the instructions which came with the engines, the plants were assembled and put into running order by the Foss crew who had had no previous experience with Ingersoll-Rand products. Mr. Foss speaks very highly of the care taken by the Ingersoll-Rand Company in preparing the engines for shipment and in providing complete assembling and installation instructions.

The 240 hp. 6-cylinder Ingersoll-Rand engine in the MARTHA has a bore of 13 in. and a stroke of 17 in. It is a direct reversible machine operating at 240 r.p.m. The auxiliary equipment on this boat is unusually complete. There is a 10 hp. Frisco-Standard distillate engine direct



Martha Foss's Ingersoll-Rand Diesel

connected to a 55 ampere 110-volt Westinghouse generator and connected through a one-way clutch to a 4-in. by 6-in. Gardner-Rix single stage air compressor which furnishes air at 200 lb. for starting the main engine.

Driven by a belt from the auxiliary engine is a 3-in. rotary pump for fire protection and for pumping out scows. A 22-ampere Westinghouse generator is operated by a belt from the main engine for supplying current for lights and for the heating elements on the main engine. These elements are used only in starting, as once underway the engine operates on the straight Diesel principle.

Connected by a clutch to the main engine is a 12½-in. by 12-in. Ingersoll-Rand single stage air compressor supplying air at 125 lb. for operating the deck machinery, pneumatic steering gear and pneumatic clutch controls. A feature of the boat is the use of compressed air for operation of the anchor winch and towing machine. This practice is becoming quite common on the West Coast, compressed air competing seriously with electricity for the operation of motor boat auxiliaries.

The MARTHA has proved highly efficient and economical in operation. She averages from 300 to 400 hours a month, and uses only 13 gallons of fuel per hour.

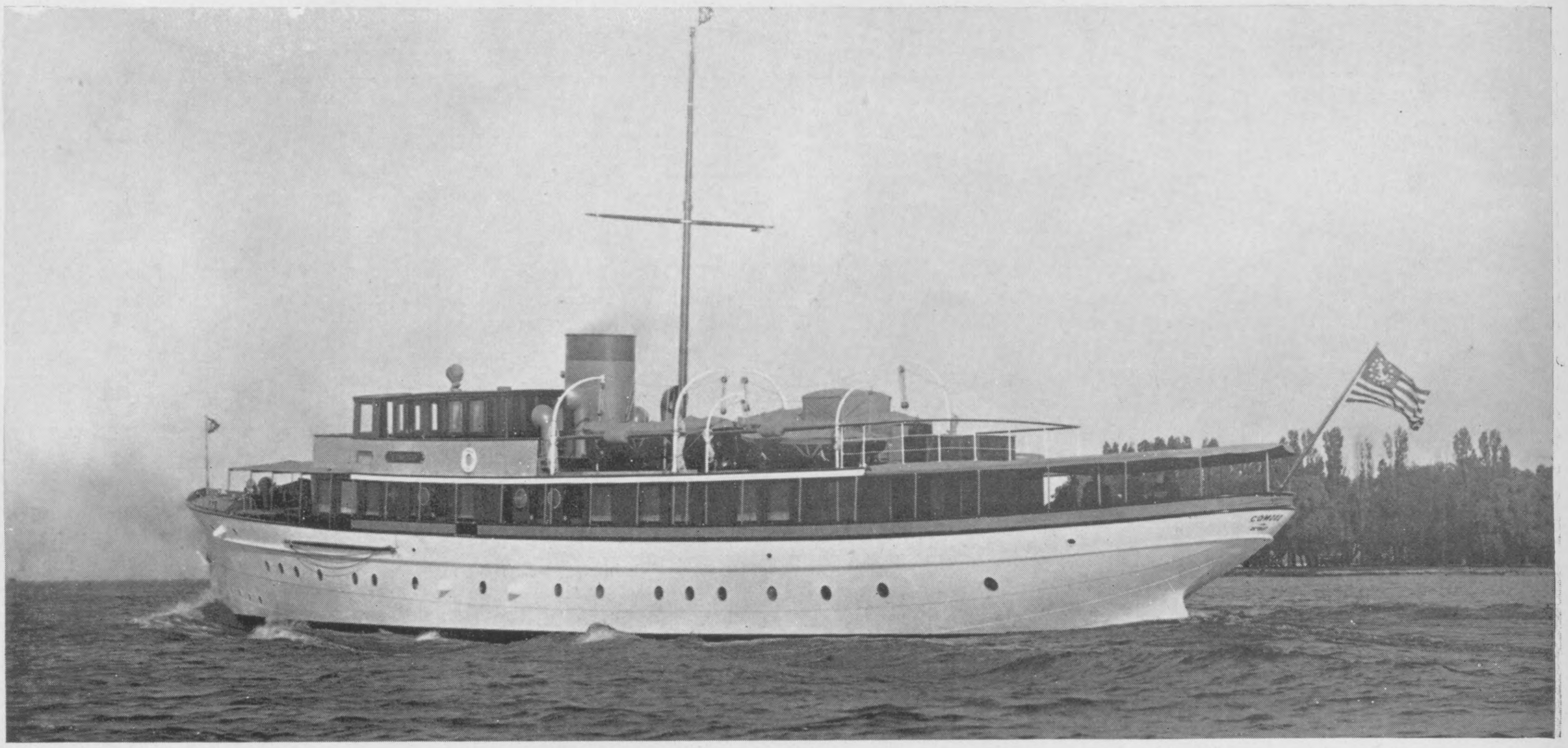
The MARTHA FOSS has been in steady operation since the completion of the installation of her new engine. Remarkable flexibility has been shown, the boat operating at 1 m.p.h. with a heavy tow or 13 m. p.h. light with equal ease. On one occasion the MARTHA towed 34 sections of logs from Tacoma to Seattle, a distance of 25 nautical miles, in 22 hours. Another time she brought a 1000-ton scow from Victoria, B.C. to Seattle in 18 hours, making a speed of 5½ m.p.h.

Powerful Runabout Tug

The tug DELANCO, built by the Rancocas Construction Co., is owned by Capt. A. C. Wescoat, Atlantic City, N. J., who has had most gratifying results from Diesel engines in his contracting business.

DELANCO is 50 ft. overall, 13 ft. molded beam, 5 ft. 6 in. depth. She is powered by a 4-cylinder 100 hp. direct reversing Standard Diesel engine controlled in the pilot house. The pilot house is located near the towing bitts so that the operator can handle the lines when towing, making a one man tow boat.

So well has Capt. Wescoat been pleased with this that he has installed and has in operation a 220 hp. Diesel suction dredge which is doing wonderful work.



Aside from being a luxurious vessel the Comoco has graceful lines

Great Lakes Produce Fine Diesel Yacht

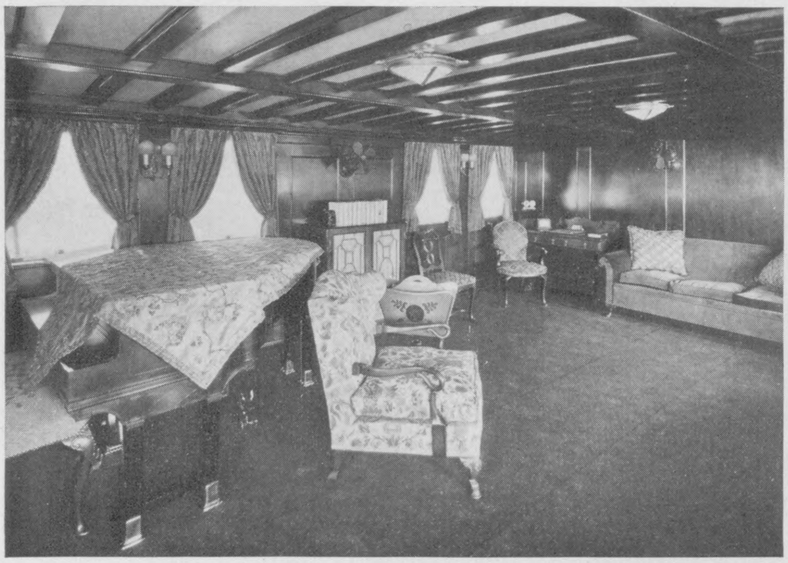
New Bessemer Engined Luxury Boat Recently Completed at Bay City, Mich., to the Order of R. W. Judson of the Continental Motor Co., Detroit

ONE of the most beautiful yachts yet placed in service on the Great Lakes has recently been completed for R. W. Judson of Detroit, president of Continental Motors, and should be considered as an excellent example of modern American shipbuilding and engineering art. COMOCO, as the craft is named, has a length of 140 ft., breadth of 23 ft. 6 in. and a draft of 9 ft. The waters around about Detroit blend themselves particularly to yachting on account of the protection afforded many of the cruisers by rivers and bays, and some of the most beautiful panoramic country in the world is around Georgian Bay. Then for long distance cruises there are the larger lakes with many points of interest ranging from the life of the city to the wilds of Northern Superior where few white men may be found. Many of the Indians still live there as they did hundreds of years ago.

Owner's quarters more resemble a bedroom in a large home than a cabin on a boat

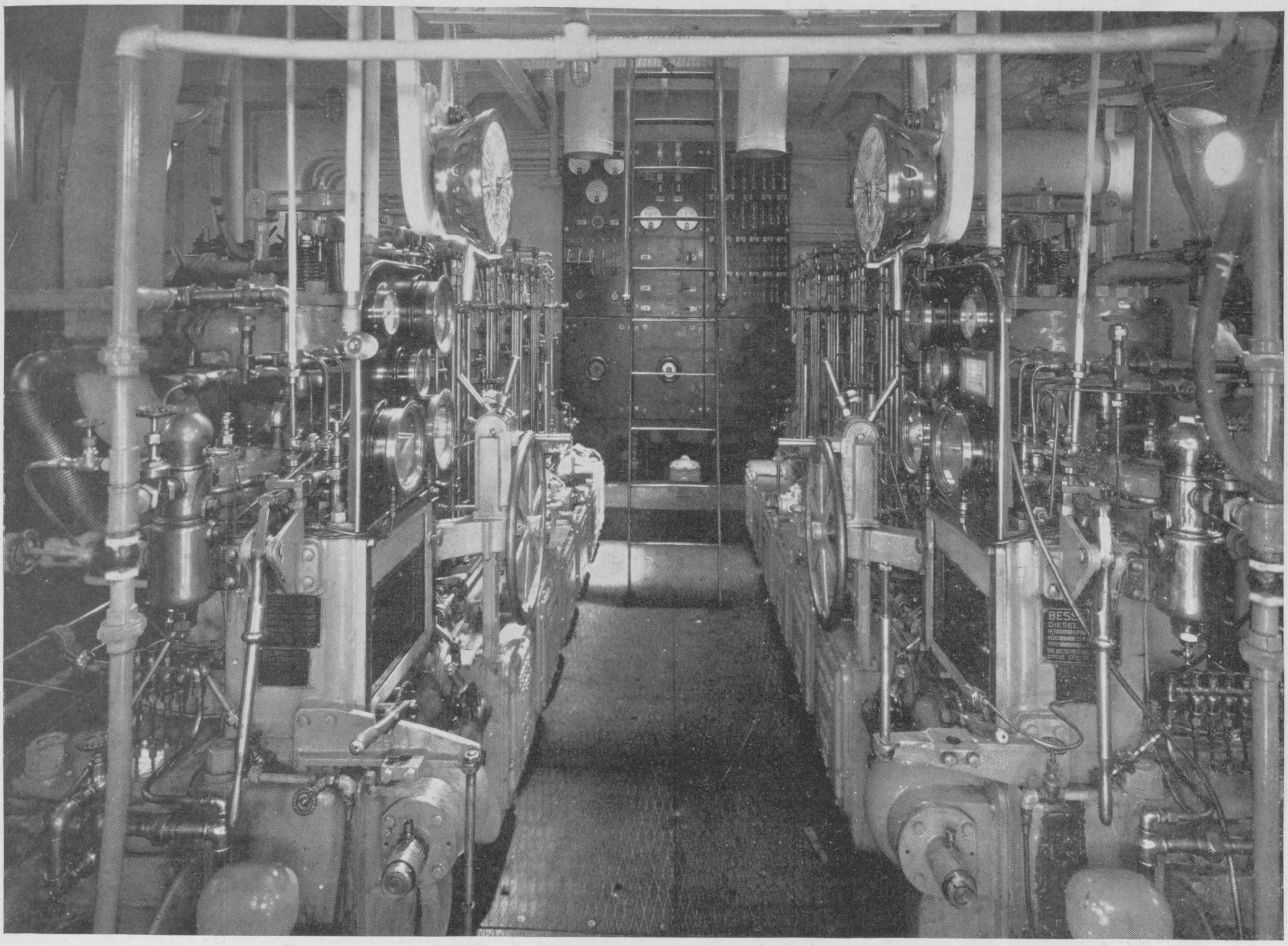
Due to Great Lakes conditions good seaworthy qualities are essential for a vessel of this size, so every possible care was taken and every study made, to produce a sound as well as luxurious job. The hull is of heavy steel, and water and fuel tanks are incorporated in the double bottom. These tanks are of sufficient capacity for a run through all the big lakes on one fueling. Not only is the hull of steel, but the deck houses are also of this metal with teak trim and teak decks.

She was designed by John H. Wells, Inc., and constructed by the Defoe Boat & Motor



Music room of the yacht Comoco

Dining saloon of Mr. Judson's yacht



Twin 300 s.hp. Diesels of the Comoco make a compact and efficient propelling unit

Works, while her main engines were furnished by the Bessemer Gas Engine Co. These consist of two 6-cylinder, 4-cycle trunk-piston, airless-injection Diesel engines of 300 s.hp. each, and the illustration clearly depicts the compact machinery arrangement.

For auxiliary purposes there are two Hill Diesel electric generating sets. These furnish power for the following electrically operated equipment: windlass, forced ventilating system, fresh and salt-water pressure sets, Nash-Jennings fire and bilge pumps, Viking fuel service pump, Kawanee water-service pump, Economy sanitary pumping system, boats' hoists, plate warmers and fans, and every room is equipped with plugs for curling irons. In addition there is a storage battery installation for light and service when the vessel is at anchor. This is a 100 cell, Edison battery of 225 amp. hour capacity.

In the owner's quarters there are five double staterooms and four baths. Each room is large, airy and luxuriously furnished. In the deckhouses are located the dining room, living room, smoking room, engine fidley, pantry and inside passage connecting the after living room with the dining room. The furnishings of the yacht deserve particular comment as Raphael studios, of New York, did a very beautiful job. In the crew's quarters there are accommodations for fifteen men; the captain's quarters being at the after end of the deckhouse. A speed of 13½ knots is available and she has proven to be a very efficient sea boat.

No Bethlehem Motorships for Coastal Trade

It is reported that several Diesel-driven cargo vessels will be constructed for the intercoastal trade by the Bethlehem Steel Corp. and operated by the Calmar Line in conjunction with Moore & McCormack. According to H. E. Lewis, vice-president, there is nothing to the rumor.

Duty on Imported Diesel Parts

A ruling that the duty on parts of Diesel engines imported is 30% has been obtained by the United Fruit Co. from the U. S. Customs under Par. 372 of the Act of 1923. They had been assessed duty at the rate of 40% under Par. 399.

Cavitation of Propellers

Before us is a reprint of an interesting article covering a theoretical investigation of the phenomenon of cavitation of screw propellers written by John Tutin in the July issue of the PHILOSOPHICAL MAGAZINE. The article is quite comprehensive and naval architects should find it well worth reading.

Steam Versus Diesel

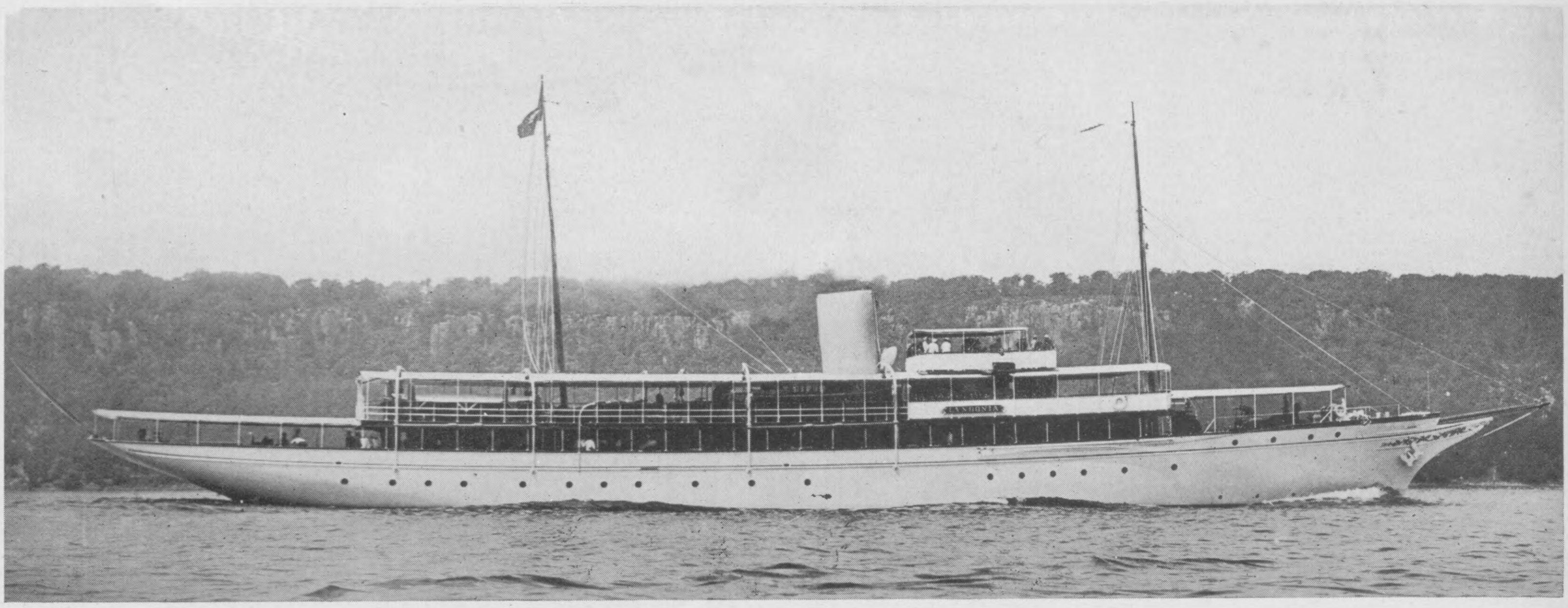
The Shipping Board has just sold an operating line consisting of six steamships of 7825 d.w. tons each for about $10 per ton deadweight. A few weeks previously the Board had turned down an offer to purchase one of its Diesel motorships—a vessel of 12,375 tons d.w. for $494,320. This would indicate that a shipowner can afford to pay far more for a Diesel-driven vessel than he can for a steam-propelled ship.

New Submarine Mother Ship

Two double-acting Diesel engines of 1800 M.A.N. design are now being built by Vickers, Ltd., of Barrow, England, for submarine mother ship.

Tanker for Union Steamship Co.

A 12,000 tons d.w. tanker of the most up-to-date and modern type will be built in an American shipyard by the Union Steamship Co. of Los Angeles, Cal. It is reported that Diesel engines will be installed as propulsive power. Wm. Groundwater, manager of transportation, advises that no definite action has yet been taken.



Diesel power has greatly improved Cyrus H. K. Curtis' yacht Lyndonia

Converted Yacht Cuts Fuel Consumption

Diesels Replace Steam in Lyndonia, Increasing Cruising Radius, Improving Stability, and Reducing Fuel Consumption. Big Storage Battery Has Been Installed for Night Load in Port

LYNDONIA, 240 ft. yacht owned by Cyrus H. K. Curtis, of Philadelphia, was converted last year from steam to Diesel drive, and on her maiden voyage from Philadelphia to Jacksonville, Fla., in very bad weather, showed a saving in fuel of two-thirds the amount used when steam driven. At 12½ knots cruising speed, at which the vessel is usually operated, her two 6-cylinder 1000 b.hp. Diesels have a fuel consumption of 6 tons per day for all purposes, as against 24 tons per day for steam drive, while in port 1 ton of fuel per day is used, as against 3 tons before conversion.

The smaller consumption of fuel has not only greatly increased the vessel's cruising radius, but also has done away with the nuisance of frequent fueling—characteristics which are both highly appreciated by yacht owners. Furthermore, conversion to Diesel drive has made it possible to install the gyro-stabilizer, added originally after the completion of the ship and located on the main deck level, down in the bottom of the ship in the auxiliary engine room, thus improving the ship's stability. While the stabilizer worked satisfactorily in its original position, there was no question but that it would function better were it lowered into the yacht's hull.

Characteristics of Lyndonia

Length overall	240 ft. 3 in.
Length, b.p.	210 ft. 0 in.
Beam, molded	30 ft. 0 in.
Depth, molded	15 ft. 9 in.
Displacement	1000 tons
Gross tonnage	812 tons
Net tonnage	389 tons
Power	2000 b.hp.
Speed (cruising)	12½ knots
Classification	Am. Bureau of Shipping
No. of Decks	3

LYNDONIA was built for Mr. Curtis by the Consolidated Shipbuilding Corporation, New York, in 1920, and equipped with two sets of triple expansion reciprocating engines, taking steam from water-tube boilers. These have been replaced by two 6-cylinder B. & W. Diesels of special yacht design (15.75 in. cylinder diameter by 18.9 in. stroke), rated for the same maximum i.hp. as the steam plant. New propellers have been fitted to suit the higher revolutions of the Diesel engines, which are 300 r.p.m. at full power, as against 200 r.p.m. for the steam machinery. The whole of the work of conversion from steam to Diesel was carried out by the Wm. Cramp & Sons S. & E. B. Co., Philadelphia.

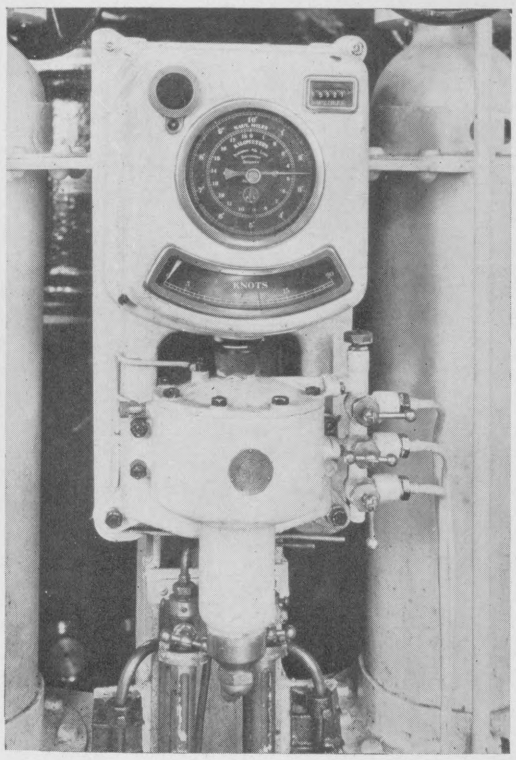
The main Diesels have been installed in the old boiler room compartment and this arrangement required an extension of the line shafts through the old engine room. In the latter compartment are now located two 3-cylinder B. & W. auxiliary Diesel engines, driving 50 kw. direct current generators and running at 500 r.p.m. The Sperry gyro-stabilizer has demonstrated to be more efficient since it has been lowered to a more appropriate position abaft the auxiliary engines, made possible by the more compact arrangement of the Diesel machinery. This relocation of the stabilizer, as well as the new type of machinery has materially increased the stability and sea qualities of the ship, lowering the gravity of the engine-room machinery as a whole.

(Continued on page 793)

The attractive dining saloon of the Lyndonia

New electric pumps for fresh and salt water, sanitary, bilge and ballast, oil transfer, etc., have been installed, as well as a rotary converter for changing direct current to alternating current for the stabilizer. The steering gear was changed to electric drive, but the windlass, boat hoists, ice machines, and ventilating fans were already electrically operated. A certain number of the old steam driven pumps were retained for standby, and these are supplied by steam from a donkey boiler, which is new and is required primarily for heating the vessel and for providing hot fresh water for baths and wash basins, located in the starboard forward wing of the auxiliary engine room. Special filters are provided in connection with the hot and cold fresh water services. Water on its way to faucets from the tanks passes through these filters, which are located in the engine room, and is robbed of all tank scale and dirt.

The laundry, previously located over the boiler room on the main deck near the up-

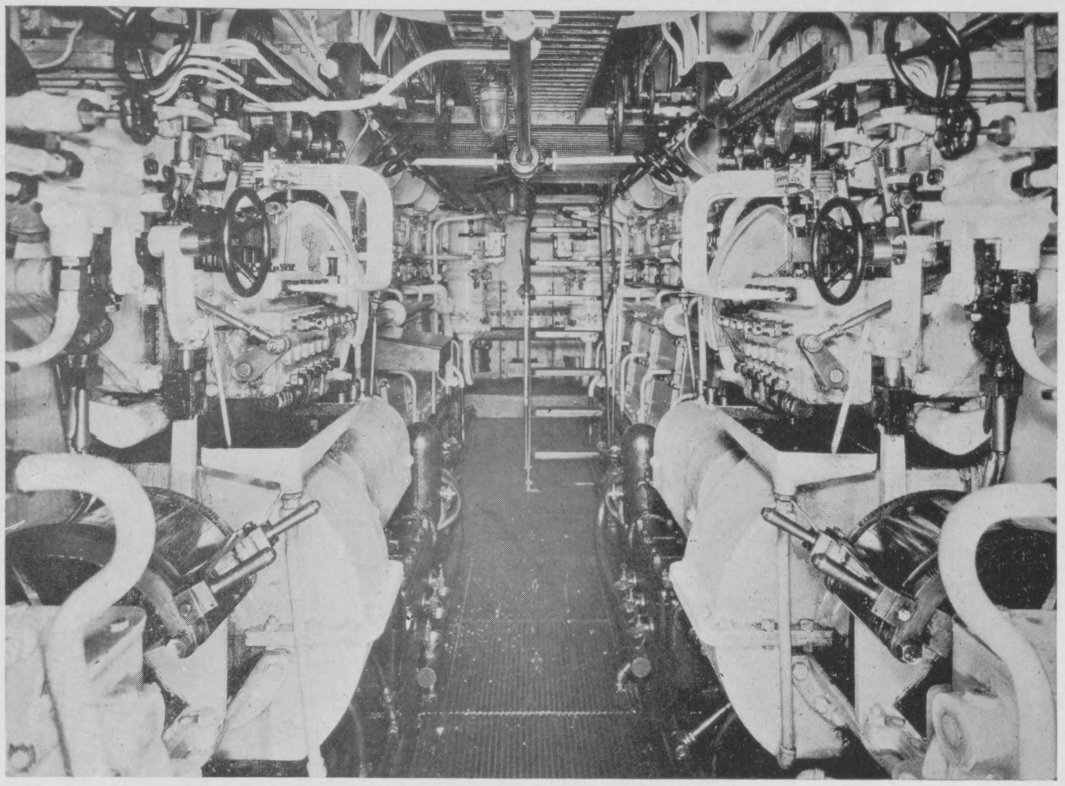


Yacht's speed indicating device on Lyndonia

take, has been shifted to a position on the port side over the old engine room, which has been decked over, and on the opposite side of the new laundry, a new trunk room convenient to the owner's and guests' quarters is provided.

A feature of considerable interest is her new storage battery equipment. At the time she was built she was equipped with a lead-type storage battery of approximately 300 amp. hour capacity for emergency service and for a few night lights. This was replaced by another battery of approximately the same capacity.

When the LYNDONIA left Philadelphia on her first trial run it became evident that the small battery was of no use with the new machinery arrangement, and it was necessary to run one of the small generator sets when the vessel was in port at night. Mr. and Mrs. Curtis are both elderly people and demand absolute quiet at night, so objected to the vibration which a small generator set sometimes produces when a vessel is at anchor.



Looking between the Lyndonia's two Diesel engines

The task of solving the problem was put up to the Smith-Meeker Engineering Co. of New York. Following their survey it was found that nothing less than 1,000 to 1,500 amp. of storage battery would enable the generators to be shut down early in the evening, and operate from the storage battery until next morning.

Due to the extremely crowded condition of the engineroom and lack of space to build a special storage-battery compartment it was found necessary to use a battery that could be installed in the machinery space without gases injuring the highly polished machinery. It was decided to instal two Edison batteries. One of 900 amp. hours capacity was installed in the engineroom to take care of all the lights in the owners' quarters, operate the steering engine if necessary and to provide current for all the sanitary service pumps, as well as for the ventilating system. In the crew's quarters a battery of 450 amp. was installed, furnishing power for the Sperry Gyro compass, forward ventilating system and lighting for crew's quarters.

Naturally this large battery capacity necessitated an entire change of the switchboard arrangement, so the Smith-Meeker Company designed and built a new switchboard for the control of all generators and batteries. This is so arranged that either of the batteries can be charged from either machine or both batteries can be charged at the same time from both machines in parallel. The control arrangement is such that if one battery becomes discharged before the other, they may be thrown together.

Automatic throw-over switches were fitted to the various oil pumps, steering gear and compass control, so that if the generators fail at any time while the ship is under way, the battery will immediately pick up the load without any interruption to the machines.

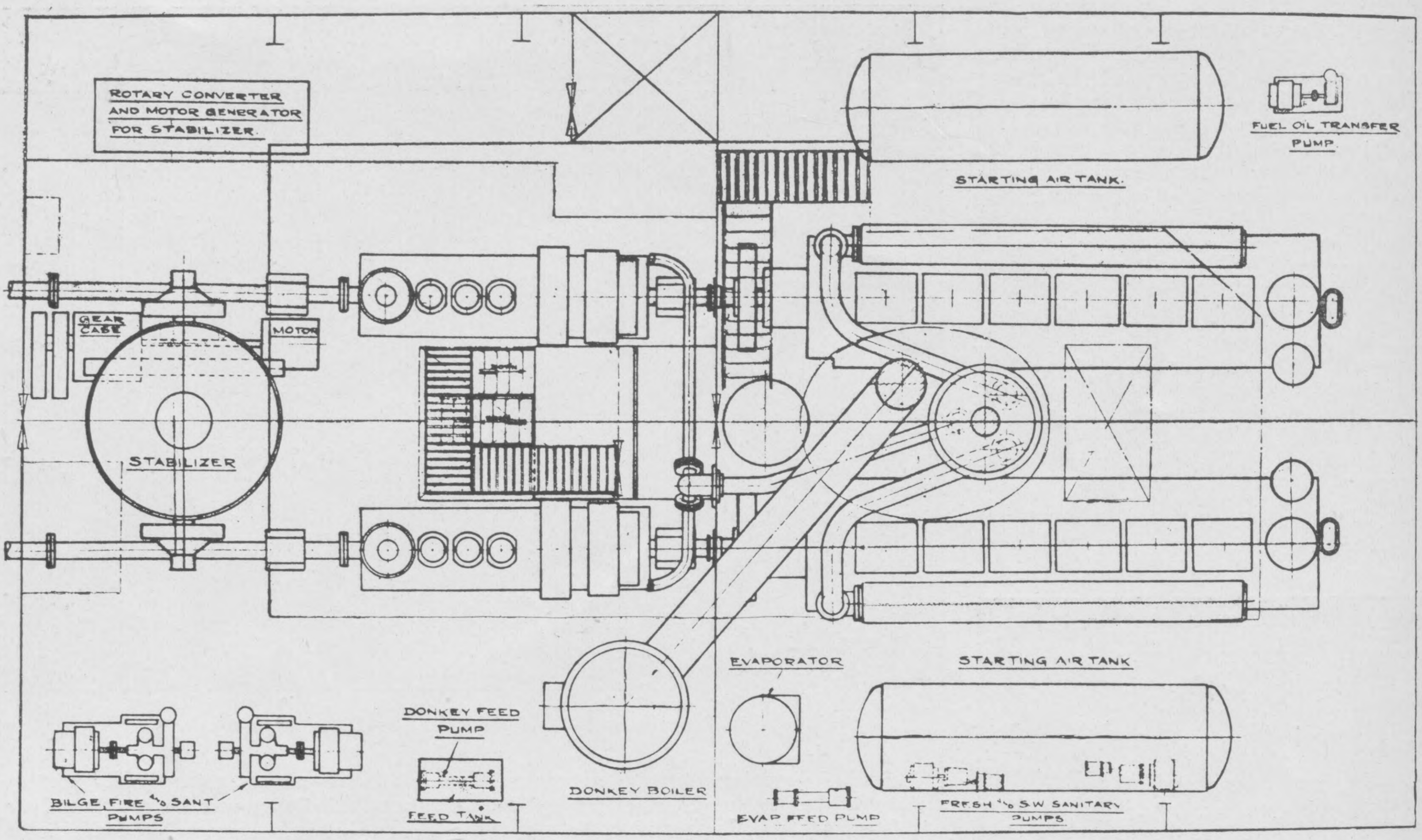
A point in connection with this installation is that, due to the type of battery installation, it was not necessary to provide any ventilation whatever nor was a battery compartment necessary. This very large size battery, which is of the greatest capacity ever installed on an American yacht, is right out in the open engineroom without any protection whatsoever. This is a unique feature and one that is worth considering in connection with any installation for marine service.

No modifications have been made in the position of bulkheads of the engine and boiler room compartments, nor were any changes made in the outside appearance of the vessel. The old engine room skylight has been retained in its original location, and the old stack has been moved aft one frame space. The silencers on the main and auxiliary engines and uptake from the donkey boiler are now located in the stack.

The total weight of machinery after conversion is approximately the same as before conversion. It is not necessary, however, to carry as much fuel oil on board as formerly, due to the much smaller consumption of the oil engines. Two cylindrical starting air tanks are fitted, one on either side of the engine room, slung under the main deck. A special propeller-operated log in the auxiliary engine room shows the speed of the ship, distance run each watch and the total distance run on the voyage.

The engine room staff comprises three engineers, six oilers, an electrician and a dayworker.

LYNDONIA has a graceful clipper bow and a long raking counter stern. These make up the 30 ft. 3 in. difference between the length overall and the length between perpendiculars. The hull is constructed entirely of steel, with decks, bulwarks, rails, and exterior joiner work of teak. There are three decks, the boat deck. main deck and lower deck. The main deck is the strength deck and the ship is handled from the boat deck, the owner's and crew's launches and two lifeboats being located in removable chocks on this deck. A teak pilot



Present engineroom and auxiliary engineroom layout of m.y. Lydonia. Position of Sperry gyro stabilizer is shown

house is arranged at the forward end. The steering wheel, engine room telegraphs, instrument board and inter-communication system, etc., are fitted at the forward end, while aft, the Captain's quarters, consisting of stateroom and private bath, are located. Steps down on the starboard side lead to the smoking room. A flying bridge is above the pilot house, and here steering wheel and duplicate controls are located. The yacht is operated from this position in fair weather. Wings on either side extend over the main deck, which permits a clear unobstructed vision from the bow to stern of ship.

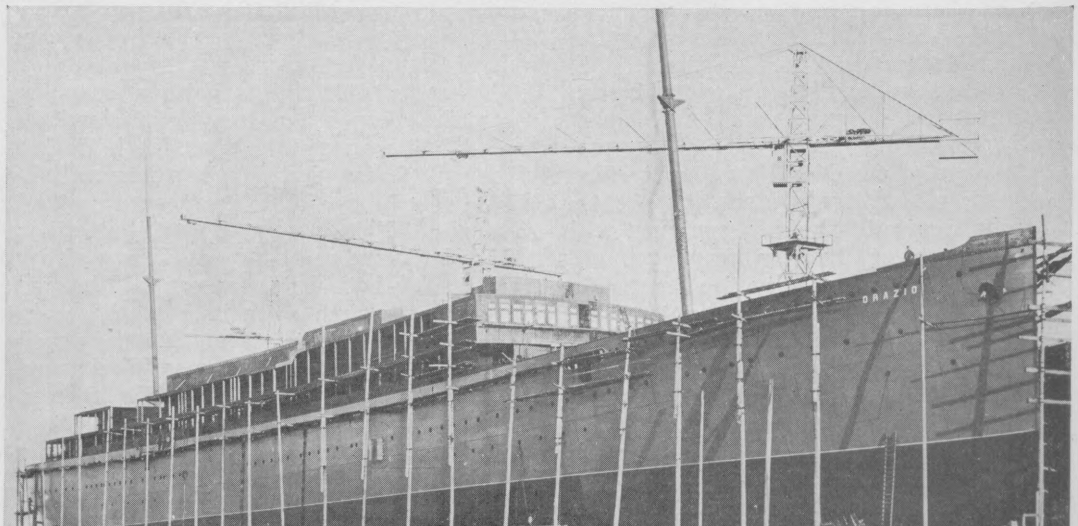
There are two pole masts of pine supported by standing rigging of forged steel wire rope, between which wireless antennæ are suspended. Wire leads from the antennæ run to the wireless room on the port side of main deck, where a complete wireless telegraph and telephone equipment is installed.

An unbroken deckhouse of teak extends practically the full length of the main deck. The dining saloon is arranged forward in this house, and is finished to represent a style in the Jacobean period. The service or butler's pantry is aft on the port side, and here is installed modern equipment, including an electrically operated service ice box. The galley is below. This is a light, roomy compartment, with a large oil-burning range fitted with electric blower at forward end. A pastry room is located on the starboard side. The cold storage plant is arranged under, with steps leading down. There is a cargo hatch on the main deck leading to this compartment. Stores may be taken aboard through this hatch without any waste handling. A dumb waiter carries food from the galley to the service pantry above. Officers' quarters and mess room are located forward of the galley.

Crew's quarters are located in the forepeak with a skylight over on deck. Bunks consist of pipe berths with springs and mattresses. The center of these quarters is utilized as a mess room, and a service door in the watertight bulkhead after permits easy access from galley.

The owner's and guests' quarters are located in the after end of the main deckhouse. The saloon is finished in satin-wood paneling. Forward is the owner's suite, consisting of two rooms and a bath running athwartships. Sliding doors open the two bedrooms into one large one, in which two three-quarter beds are arranged. A winding staircase on the starboard side of the saloon leads down to six guest staterooms, all finished in enamel, each with a private bath.

LYNDONIA may now be grouped among the largest motoryachts afloat, and there is every reason to believe that her owner is well satisfied with his change, on account of the many conveniences and economies which Diesel power has brought with it.



The 16,700 tons displacement passenger-cargo motorship Orazio completing for the N. G. I.'s service between Italy and Central America. Two Triestino Diesel engines aggregating 6600 i.hp. are installed

Small Mechanical Injection Diesels--Part 3

Conclusions Made as a Result of Second Run and Third Run Experiments and a Complete Discussion on the Work

(Continued from page 709, September)

THE difficulties experienced in the four-hole nozzle plate made it seem that distribution was not correct. It was considered that in the air injection engine the fuel was carried into the combustion chamber by a highly energized vehicle. At the end of compression in the mechanical injection engine the compressed air was practically still and no movement of air currents was possible. When fuel was introduced or sprayed into this space there was no opportunity therefore for the thorough intermixing of fuel and compressed air. The four-hole nozzle therefore could only avail itself of a limited amount of oxygen to support combustion of its fuel spray. The new nozzle designed, was drilled with five holes. These holes were drilled through a section of metal

New and old nosepieces

which was made very thin so that sharp-cutting orifices would result. After drilling the orifices, a larger drill was used to clean off the burrs on the outside of the nozzle surface. In the previous type, difficulty was experienced with these burrs as they had a tendency to deflect the fuel spray and prevent a cylindrical stream emerging from the orifices.

A new nosepiece was designed which gave a fuel opening of 30 deg. The profile of the nosepiece was so designed as to give a very sharp opening. The new design is illustrated in Figure 13, which shows that the closing of the valve is gentle. A comparison of the new nosepiece with the old one is shown. The dotted line represents the early type and the heavy line the improved type. With this improved type of nosepiece the time of opening varies very little in proportion to the lift of the fuel needle. The closing point, however, varies according to the duration of the fuel injection period.

The new type of fuel valve was installed and the resilient tube was shortened to suit the new conditions. The apparatus was then ready for the second run of experiments.

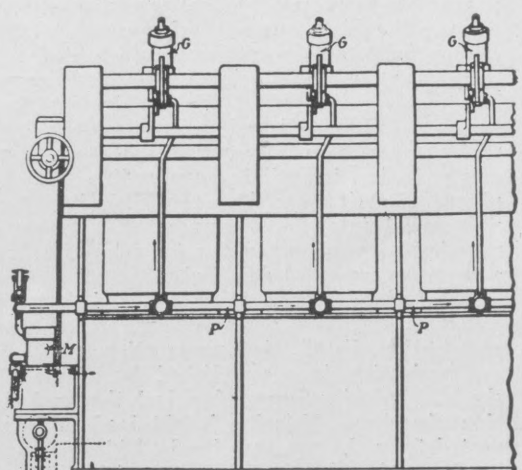
The single cylinder operated very nicely with the new arrangements. After the proper adjustments were made in fuel valve timing and fuel injection timing, the exhaust ran very clean and appeared to give satisfaction. The exhaust temperatures were lower and the cooling water temperature was lower, showing that afterburning had been considerably reduced. The best results were obtained when the fuel valve opening was advanced to 8 deg. before top dead center. The results appeared to be satisfactory enough to warrant fitting the other two cylinders with the same style of fuel valve. The same eccentric arrangement was used for controlling the lifts of the fuel needle and the same length of resilient tubing was applied to each engine cylinder. The governor was attached to the mechanical injection fuel pump and the air injection pump was removed. The governor, therefore, controlled the fuel pressure by regulating the amount of by-pass through the suction valves. The regulation of the needle lift was not linked up with the governor as it was considered that an adjustment of the needle lifts would be sufficient for the trials.

When the pump was set so that the beginning of fuel discharge at full load was at 56 deg. after top dead center, the exhaust gases ran clean. The fuel pump pressure was less variable at full load.

After conditions were fairly well established it was decided to operate for three days continuously at full load. Operation was satisfactory and the exhaust gases clear for the first 12 hrs. A slight haze then made its appearance in the exhaust gases. This haze continued to become more dense as time went on and caused a slight reduction in power at the adjustment set. By raising the fuel pressure from 3,500 lb. to 3,800 lb., the full power was again resumed. In an hour's time the load again dropped off and a further boost in pressure was necessary. Shortly thereafter it was necessary to reduce the lift of the needle in order to cut down the amount of smoke in the exhaust. By further increasing the fuel pressure and cutting down the valve lift, peak pressures of over 600 lb. were noted on the indicator card. After eighteen hours' running it was impossible to make any further adjustments which would maintain the full load on the dynamometer at the rated speed. Smoking became severe and the power dropped rapidly as the test continued.

While the engine was in operation, one fuel valve body was removed and the nozzle condition observed. Carbon tubes had formed at the orifices of the nozzle. These tubes prevented the correct spraying of fuel. After cleaning the orifices, the fuel valve was again inserted and the other fuel valves were likewise removed and cleaned. In some cases the orifices were found to be choked with carbon or a long thread-like substance which successfully passed through the strainer plate. After the nozzles were cleaned, operation continued with a clean exhaust for ten hours. The same adjustments found necessary in the previous case had to be resorted to again to maintain full load power. After continuing in this way for several days, the engine was stopped and the following conclusions noted:

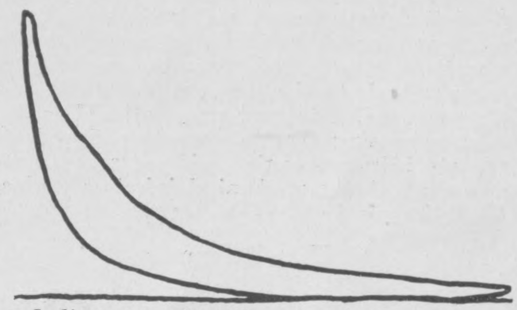
A constant spraying pressure was found desirable under all load conditions. Any influence which tended toward causing the pressure of fuel behind the orifices to remain



Fuel discharge from common manifold

constant during the spraying period, materially added to the efficiency of the system. Therefore, the method by which fuel pressure was controlled, warranted careful attention.

The 3-plunger fuel pump was re-machined in such a way that the discharge from each pump plunger was brought into a common manifold. The fuel pump had previously been designed with a total capacity equal to four times the amount of fuel required at full load operating conditions. To preserve a more uniform discharge, the pump plungers were reduced in size to give a capacity of two times that required for full load operation. In this way the discharge pressure would be more uniformly controlled at the fuel pump. As


Indicator card with reduced compression

difficulties had been experienced with the packing around the fuel pump plunger, the smaller plungers were provided with a reduced size of packing.

It was decided that the resilience was too great and tests were made to determine the resilience of fuel oil at 4,000 lb. pressure. The result of this test proved that the elasticity of fuel was about 0.00007 of the original volume per atmosphere of pressure. During the discharge period of the fuel pump, the pressure raised on a gradual slope due to the elasticity of the fuel.

The steel tubes were abandoned and small tube connections were made to a large steel tube which served as a manifold. Fuel discharge from the fuel pump entered this common manifold as illustrated. The size of the manifold was determined to prevent wire-drawing to the fuel valves. The resilience of fuel oil itself was considered sufficient to care for the pulsations of the fuel pump. The fuel pressure gauge was attached to one end of the manifold at the tail end of the fuel system. The pressure gage, therefore, indicated the lowest pressure in the system. The gage was also served by a pulsating chamber in the form of a common manifold.

The fuel valve construction was considered satisfactory and the only change made was in the flame plate in which five smaller holes were drilled at an angle suitable for correct distribution.

The fuel cam opening was reduced and the abrupt angle of the entering profile of the nosepiece was slightly rounded. The inertia of the fuel valve rocker was reduced by lightening the parts and providing heavy springs to cause the valve roller to follow the cam profile.

The compression pressure was reduced to 400 lb. per sq. in. It had been noticed in the previous experiments that the indicator card showed a decided jump from the end of compression to the maximum peak pressure. It was almost impossible to reduce this jump below 100 lb. The engine used for the experiments was designed as a 525 lb. maximum

pressure unit. It was, therefore, desirable to keep the peak pressures within this limit. On the basis of these changes another run of experiments was conducted.

When the proper adjustments were made in fuel valve timing it was found that the fuel pump could be placed in almost any position with respect to the discharge periods of the fuel valve. The cooling water temperature ran lower than in the previous case and the exhaust temperatures ran lower also.

When combustion was made practically perfect by the correct adjustments, a 6-day continuous run at full load, was conducted. During this test it was found that no adjustments or changes were necessary and that the load and speed required by the dynamometer, remained practically constant during the entire period. The exhaust was just as clean at the end of this test run as at the beginning. The indicator card produced on this run is illustrated. In analyzing this card, it can be seen that the maximum pressures run to about 525 lb. per sq. in. The exhaust pressures run about 45 lb. per sq. in. In an attempt to lower the exhaust pressures it was found necessary to advance fuel injection, which in turn raised the initial peak pressures. These peak pressures ran about 625 lb. and caused severe vibrations. The adjustments were then brought back to the previous conditions and the same indicator card was produced.

In comparing the horsepowers obtained on the air injection engine with attached compressor, with the mechanical injection engine, the following facts were determined:

Heat Balance

	Air Injection	Mechanical Injection
Accounted for by indicated power	44.94 %	44.79%
Mechanical efficiency	73.0 %	78.1 %
Accounted for by b.hp.	32.806%	34.98%
Heat rejected to cooling water, exhaust gases & radiation	55.06 %	55.21%
Indicated mean effective pressure	105 lb.	98.6 lb.
Brake mean effective pressure	76.65 lb.	77 lb.

Mechanical Losses

Due to air compressor.	6.8 %	....
Due to mechanical injection fuel pump	....	1.7 %
Net reduction of mechanical losses by use of mechanical injection	....	5.1 %
Fuel consumption per b.hp. hr.	0.43	0.389

The fuel valve construction proved satisfactory for the power requirements and speed conditions. The size of the orifices was definitely determined and the value of the velocity requirement was established. The fuel nosepiece had a satisfactory profile which could be followed by the fuel valve roller. The fuel pump gave satisfactory results. For variable speed control it appeared necessary to regulate both the fuel pump pressure and the lift of the fuel valve.

The above experiments proved that in this case the mechanical injection system could be operated successfully over extended periods under proper operating conditions. For small engines the horsepower developed by the mechanical injection engine could not be materially improved by the elimination of the air compressor when considering the two limiting features, preventing the overloading of a Diesel engine. The temperature of the exhaust gases determines the length of life of the exhaust valve seats. Higher exhaust temperatures materially reduce the life of exhaust valves. It is, therefore, desirable to hold the exhaust gas temperatures within practical limits similar to those established by air injection practice.

The cooling water temperature determines the possibility of maintaining a lubricating oil film on the cylinder walls. If the rate of heat transfer through the cylinder walls is so slow that it causes the inner skin of the cylinder to become highly heated, the lubricating oil film will break down and piston seizures will result. The temperature of the cooling water or the waste heat extracted from the cylinder by the cooling water, should not be much higher than that found satisfactory in air injection practice.

An advantage revealed in these experiments by the use of mechanical injection was a reduced fuel consumption over the air injection system. The fuel consumption of the air injection engine amounted to 0.43 lb. per b.hp. hour at full load. The fuel consumption of the mechanical injection engine amounted to 0.389 lb. per b.hp. hour.

The test conducted to determine the minimum speed at which operation could be carried, proved that the mechanical injection engine was more flexible than the air injection engine. In the air injection engine the speed could be reduced from 250 r.p.m. to 120 r.p.m., while in the mechanical injection engine the speed could be reduced from 250 r.p.m. to 72 r.p.m. The control of speed reduction in the air injection engine necessitated the adjustment of the quantity of fuel discharged by the fuel pump as well as the injection air pressure and the lift of the fuel valve. In the mechanical injection engine speed reduction necessitated cutting down of the fuel pressure and reducing the lift of the fuel needle. The mechanical injection engine, therefore, had greater flexibility with simpler controls.

From the experiments discussed in this article, the following principles were established:

To successfully consume fuel in the cylinder of an internal combustion engine of the high compression type, it is necessary to have proper compression. In the air injection Diesel engine the compression pressure is high enough to guarantee starting under low temperature atmospheric conditions. When the air injection fuel valve opens, the expansion of high pressure air from 1,000 lb. to 500 lb. per sq. in. causes a refrigerating effect in the combustion chamber. This influence reduces the temperature of the incoming atomized fuel sufficiently to prevent ignition at compression pressures lower than 420 lb. per sq. in.

In the mechanical injection Diesel the cycle is a mixed one and therefore allowance must be made for the peak pressures obtained during the initial combustion period. It is seldom possible to limit this jump during the initial ignition period lower than 100 lb. If the maximum desired peak pressure is 500 lb. per sq. in., the compression pressure would be 400 lb. per sq. in. At this compression pressure starting can be accomplished with incoming suction air as low as 35 deg. Fahr .This is possible in the mechanical injection engine because the high rate of fuel travel into the combustion chamber causes considerable heat to be liberated in the vicinity of the fuel spray. The refrigerating effect of the air injection system is eliminated and in its place the fuel particles are given a higher temperature than exists in its immediate surrounding atmosphere. Starting can be accomplished in the mechanical injection engine at 350 lb. compression pressure when the incoming air has a temperature of 60 deg. Fahr.

The fuel valve must be so designed that the following functions are properly carried out: atomization, distribution, penetration.

Atomization is accomplished by virtue of the high velocity flow of fuel into the combustion chamber. Velocity is obtained or converted from the pressure head. This pressure head was found to be 3,500 lb. to 4,000 lb. per sq. in. The spray becomes coarse and dense as soon as the velocity drops below a certain value. Combustion is then delayed and a smoky exhaust results.

Distribution is accomplished by selecting the proper number of orifices to direct the fuel into the combustion chamber where the oxygen is concentrated.

Penetration is accomplished when the relation between the fuel pressure and the diameter of the nozzle orifices is such as to allow the fuel particles to have sufficient speed of movement to reach the remote recesses of the combustion chamber. As atomization becomes finer or as the pressure is increased, penetration is reduced. The small fuel particles then do not have sufficient energy because of their small mass, to carry them to the proper destinations.

Distribution and penetration are often assisted by turbulence. Where turbulent influences are introduced, oxygen is caused to travel in the path of the injected fuel spray. In this way the intermixing of fuel and air can be accomplished without high penetrating qualities or without a great number of distributing orifices. When turbulence is present, the oxygen within the combustion chamber is in a state of motion and materially assists in reducing high explosive pressures.

The control of the rate of feed of fuel into the combustion chamber requires considerable attention. Fuel should burn as fast as it enters the combustion chamber. If the rate of feed can be controlled so that pressure within the cylinder does not rise until the piston is on its outward expansion stroke, the maximum pressures will be considerably reduced.

Sufficient resilience is obtained in fuel oil to eliminate the necessity of elaborate pressure regulating devices in small engines. In some cases a regulator is used to absorb pump pulsations only. A multiple plunger pump of no greater than twice the capacity required for full load operation, will produce a uniform pressure in the common discharge manifold. A by-pass regulation on the suction valve of the fuel pump will control the fuel spray pressure at any speed or load condition desired by the operator.

The best governing results are obtained when the governor controls the discharge pressure of the fuel pump simultaneously with the lift of the fuel valve needle.

The overhead camshaft provides a better arrangement for confining the movement of the valve roller to the profile of the fuel cam.

(To be continued)

Twin Eight-Cylinder Engines for Passenger-Cargo Motorship

In these days of double-acting Diesel engines it is not often one hears of eight-cylinder engines being built. Consequently, it would be interesting to know the engineering considerations for two eight-cylinder, single-acting, four-cycle engines of 2300 s.hp. each at 125 r.p.m., having been ordered for the passenger-cargo motorship now building for the Royal Packet Navigation Co. of Amsterdam. Especially as another company has ordered seventeen motorships with single-screw, double-acting Diesels of the same make, namely Werkspoor, and of the same total power per ship.

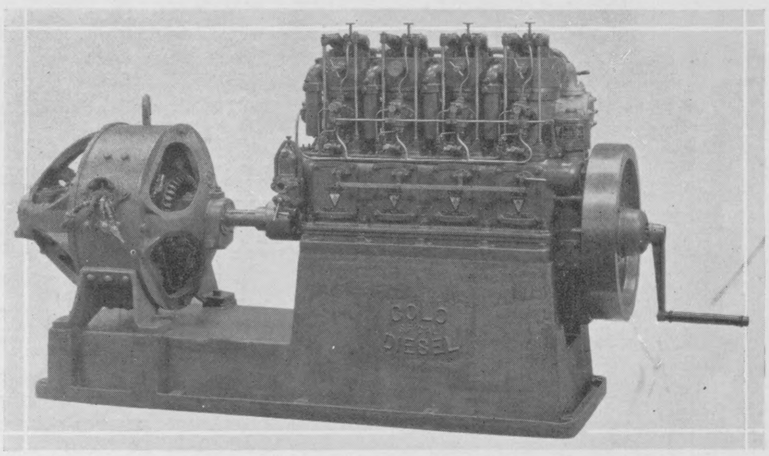
The Colo Airless-Injection Diesel

Small 4-Cycle Engine, Suitable for Auxiliary Power and for Workboats, Has Pre-Combustion Chamber and Long Piston Projection

THE Colo Diesel engine, a 4-cycle airless-injection machine of small bore and high speed is one of the latest additions to the small marine Diesel field. It has several features which make it worthy of note by owners interested in fitting internal combustion engines to towboats and small workboats and is available in one, two, three and four cylinders, all having the same bore and stroke, namely, 4.8 in. by 7.1 in. The engine is rated to deliver 8 b.hp. per cylinder at 750 r.p.m. The weight of the four-cylinder engine including flywheel, silencer, fuel tank, and spare parts is quoted as 1840 lb., a figure corresponding to about 50 lb. per b.hp. for the complete installation.

Individual cams drive the fuel pumps which are equipped with a hand lever for priming and for throwing each pump separately out of commission by raising up the roller. A novel method of regulating the pumps consists in the use of a static bypass needle subject to hand or governor control. The wider the needle is open, the less oil is forced to the injection valve. and would be incapable by itself of doing much throttling or exerting much of any other influence. However, the neck is substantially blocked off during injection and most of combustion by a steel plug screwed into the piston head. Every time the piston comes to the dead center the plug dips into the throat with sufficient clearance to avoid metallic contact.

As the piston approaches top dead center during the compression stroke the entrance of the tip of the plug into the combustion chamber neck sets up a pronounced displacer action due to the rush of air from the diminishing space between the piston and the cylinder head. Just at the moment when the plug has entered, there is still considerable air left around the shank of the plug. By the time the piston actually reaches top dead center practically all of this air must have flowed through the annular opening formed by the neck of the pre-combustion chamber and the plug projecting into it. The flow of air thus set up causes pronounced turbulence within the chamber, which is claimed to further the



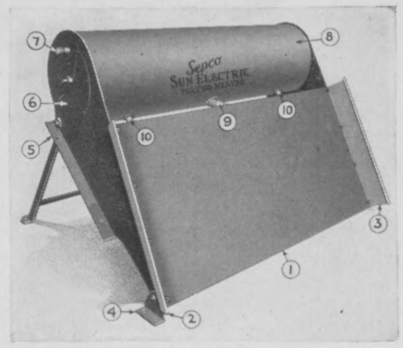
Auxiliary generator engine of 32 b.hp.

Outside of the pump plunger and the usual suction and discharge valves, there are no moving parts on the pump.

Attention is directed to the fact that this is one of the few 4-cycle airless-injection engines operating with a pre-combustion chamber. The cylinder heads are cast solid without separate valve cages, while the valve heads themselves are seated directly on the metal of the cylinder head casting. As the result of this construction valves of ample size can be used without encroaching seriously on the space left open between the valve pockets. It is here that the pre-combustion chamber is located concentrically with the axis of the working cylinder. As the exhaust and inlet valve passages are deflected slightly to one side, cooling water space also remains between the chamber walls and the passages.

Although the cylinder is fitted with the construction or "neck" characteristic of most pre-combustion chambers, the throat is nearly as large as the chamber itself combustion of fuel as soon as it is injected.

Although there is probably a considerable pressure rise in the chamber as soon as combustion gets well under way, it is retarded in communicating itself to the cylinder and piston because of the constricted passage remaining between the surface of the plug and the contour of the throat. At the same time this annular space probably forms a sort of orifice, through which the pressure rise due to ignition violently expels the chamber contents into the main cylinder space. The combined effect appears to be that of greatly assisting combustion by means of accentuated turbulence and at the same time of preventing an undue pressure rise within the cylinder bore. As the diameter of the pre-combustion space is limited, it can easily be made of ample strength without unduly thickening its walls. The Colo Diesel is being marketed in the United States by F. Van Rossen Hoogendyk, Graybar Bldg., New York, and of San Francisco, Cal.



Sun-Electric Water Heater

An interesting device for utilizing the sun together with electricity as a means of heating and storing water for yachts or commercial motor-vessels has been produced by a Philadelphia concern, whose standard type electric water heaters and coffee urns, etc., are in use on the Shipping Board conversions. On days of mellowed sunshine or days without sun a precision electric heating unit, combined with thermostatic electric control will enable the ship's current to instantly replace the sun heat. The unit illustrated will furnish at least 50 gal. of hot water which can be stored in a thermos-type tank.

Storage Batteries as Auxiliary Power for Yacht

Another Diesel yacht has just been completed in England for an American owner. This is the 550 tons twin-screw boat CRUSADER built for A. K. Macomber by Camper-Nicholson of Gosport, and equipped with two 400 b.hp. Sulzer Diesel engines. It is interesting to note that for emergency, light and power in part this vessel has two big Edison batteries having a total capacity of 450 amp. hours.

Double-Acting Engines in Tanker

PHOBUS, first of the 17 tankers now being built and equipped with 3500 b.hp. Werkspoor double-acting Diesel engines for the Anglo-Saxon Petroleum Co., recently completed her successful maiden voyage averaging a speed of 12 knots on a daily fuel consumption of 14½ tons and a lubricating oil consumption of 15 gal. per day.

Imperial Oil Orders Big Tanker

A Krupp-Diesel tanker of 16 000 tons d.w. to be built on the Isherwood Bracketless system has been ordered by the Imperial Oil Co. Ltd., from the Furness Shipbuilding Co., Haverton Hill-on-Tees. The Imperial Oil Co. is the Canadian subsidiary of The Standard Oil Co. of N. J. Two 15,600 tons Diesel tankers are also building for the Imperial Oil Co. at Alexander Stephen & Sons, Linthouse, Scotland.

Big Yacht for S. A. Salvage

Pusey & Jones, of Wilmington, Del., will build the 150 ft. Winton Diesel yacht for Sam. A. Salvage of New York. This is the boat referred to last month as being designed by W. Dobson of New Bedford. She will be modern in all respects.

Scraper Device on Oil Purifier

Development of New Mechanism for Removing Dirt from Centrifugal Bowls

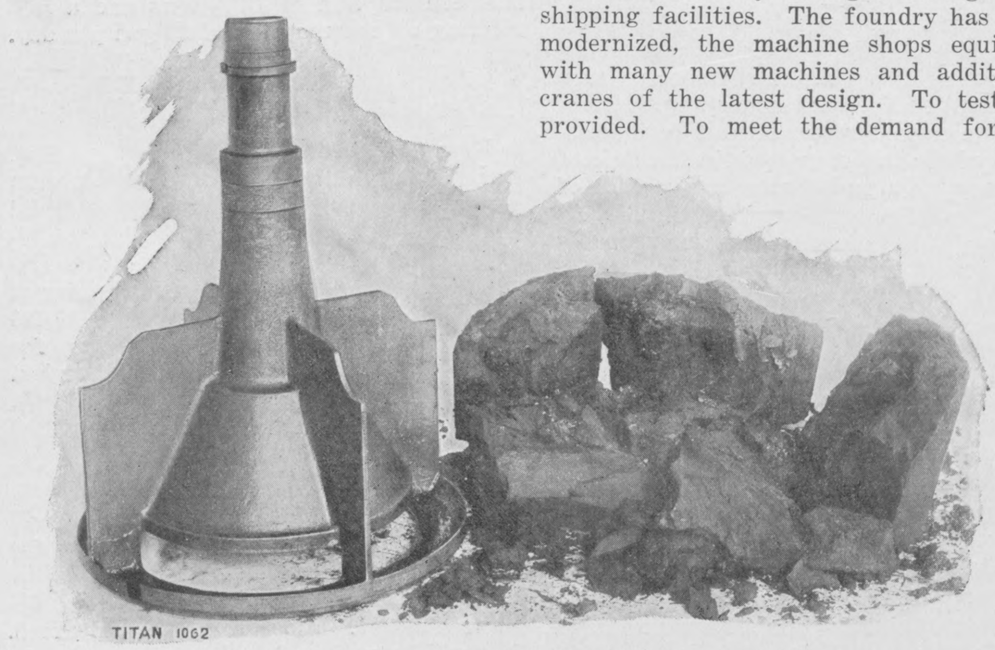
WITH earlier designs of oil centrifuges much time was lost in cleaning the bowls, and where the labor involved was a factor in preventing frequent washing or scraping much of the separator's efficiency vanished. Naturally manufacturers have paid considerable attention to developing designs that greatly reduce the amount of necessary effort, with consequent improvement in all round effectiveness. Our attention has been drawn by the Engineering Specialties Company of New York to a patented scraping edge bowl developed by Titan Ltd. for their oil purifier, which greatly reduces the time required to clean their machine.

Scraper lifted out with accumulation of dirt

It will be noted from the illustration that the scraping edge fits neatly into the bottom of the bowl and is an integral part of it. When it becomes necessary to remove the dirt from the bowl, covers are removed and a handy screw-jack fastens to the upper end of the scraping edge, draws it out scraping inside surface of bowl and bringing with it all the dirt in one mass. As will also be seen the dirt is easily and quickly removed from the scraping edge. It is then replaced in the bowl and re-assembled and the machine is back to work again in a very few minutes.

Another distinct feature of this construction is that in a plate type bowl, it eliminates the necessity of separating the plates for cleaning. The old method requires that the plates be taken out separately, scrubbed and cleaned, cleaning the bowls separately, plates re-banked and re-inserted in bowl.

With the new Titan scraping edge, the plates come out together with the dirt and the scraping edge, leaving the bowl clean. It is only necessary to remove the dirt from the edges of the plates and the scraping edge, brushing them off while they are still assembled. The entire plate assembly is then re-inserted with scraping edge as a unit in bowl. It is never necessary to separate each plate for cleaning. The system now is incorporated in all Titan oil purifiers.



Showing matter extracted from oil by the centrifuge

Concentration of Worthington Construction Facilities

According to L. J. Belnap, President of the Worthington Pump and Machinery Corporation, the transfer of certain types of Diesel engine construction from the recently closed Blake and Knowles plant at Cambridge to the newly enlarged Snow works in Buffalo is the latest step in his policy of concentrating facilities for increased efficiency in economical operation.

For the last two years the Snow plant has been expanding and modernizing to prepare for this transfer. The Snow plant is now completely renovated. The best of the Cambridge plant equipment has been moved in and installed in space newly ditional power, a large new power plant has been built. Extra tracks laid in the yard serve the recently enlarged storage and shipping facilities. The foundry has been modernized, the machine shops equipped with many new machines and additional cranes of the latest design. To test the provided. To meet the demand for ad-Corporation's Diesel and gas engines of the various types and sizes the most modern erection floors and test stands have been constructed. To assure effective supervision and inspection the Corporation's Diesel engineering talent has also been concentrated at this plant.

The large double-acting U. S. Shipping Board Diesel engines were built at the Snow works. These engines, the first to be installed in the Government's cargo ship conversion program, are, according to their operators, giving a good account of themselves in the motorships TAMPA and UNICOI. Besides the concentration of the complete line of Diesels at this plant there has been added the manufacture of a Diesel designed for fishing boats, small stationary and portable applications such as excavating shovels and hoisting rigs, and for driving small pumps and compressors.

Atlantic Coast from St. Croix River to Cape Cod

Before us is a copy of the new edition of the United States Coast Pilot, Atlantic Coast, St. Croix River to Cape Cod, published by the U. S. Coast & Geodetic Survey of the Dept. of Commerce. This volume, which replaces a previous edition published in 1918, contains a wide variety of nautical information which will be of value to navigators for the purpose of supplementing their charts of this section of the coast. It has been compiled from information received from a number of sources including a special examination of the entire region by the Coast and Geodetic Survey.